

Popular Science



★ FOUNDED MONTHLY 1872

**Naval
Wonders
of the
next war**

— See page 30

\$1,000 IN CASH PRIZES EVERY MONTH

JUNE

See Page 12

25 CENTS

"Not at all - the aroma
is delightful"



Chesterfield

CIGARETTES



Tycos Instruments

Save Time and Money in Making

GOOD YEAR

T I R E S
TEMPERATURE control is of the utmost importance in curing heaters, where rubber is cured by steam. A variation of $1\frac{1}{2}$ degrees from the correct temperature is practically certain to injure the rubber.

Prior to 1917 Goodyear was using hand regulated steam controls on the curing heaters, but decided to install Taylor instruments because the temperatures could not be controlled accurately by hand. There are in use about 150 of the Taylor "Dubi-Duty" temperature and time regulators, 225 of them being in constant use. With them the temperature of the curing heaters never varies more than 1 degree and consequently injury is rare. This alone justifies the cost of installation, for it has resulted in hundreds of dollars in savings.

But even more savings were effected, for the use of these instruments has saved the labor of ten men. Formerly one man could only watch four heaters at the most. Now he can watch ten if necessary. All men have to do is fill the heaters and turn on the steam. The Taylor instruments automatically regulate the temperature and the timing device shuts off the steam at the right time. Besides the "Dubi-Duty" instruments on which Goodyear has standardized, they are using several hundreds Taylor industrial thermometers and a number of temperature and pressure recorders. They have always found Taylor instruments to be thoroughly dependable.

TO MANUFACTURERS

In the Tycos line of 3000 different kinds of Heat Indicating, Recording and Controlling Instruments there are instruments that will help you take the guess out of your manufacturing problems. It will pay you to learn how other manufacturers are using the Sixth Sense of Industry to get uniform results. Informative literature on any type of instrument will be sent you on request. Or our engineers will consult with you on the application of Tycos to your particular manufacturing process.

Taylor Instrument Companies

Main Office and Factory
 ROCHESTER, N. Y. - U. S. A.
 Canadian Plant: 500 BUILDING, TORONTO
 SHORT & MASON, Ltd., Manufacturing Distributors in Great Britain



**Tycos -
for the
Home**

Tycos Office Thermometers
 An aid in promoting better efficiency.

Tycos Bath Thermometers
 To enable you to get the most good from your bath.

Tycos Wall Thermometers
 To help you to maintain a temperature in your home conducive to good health.

Tycos Quality Compasses
 To show you the right way in unfamiliar country.

Tycos Hygrometer
 To enable you to keep the humidity of the atmosphere in your home correct at all times.

Tycos Home Set
 Baking Oven Thermometer, Candy Thermometer, Sugar Meter. The secret of accurate results in cooking.

Tycos Fever Thermometers
 A necessity in every home.

Tycos Stormguide
 Forecasts the weather twenty-four hours ahead with dependable accuracy.

Your dealer will show them to you. Ask us, on a postal, for booklets on any of the above

**Tycos -
for the
Medical
Profession**



Tycos Sphygmomanometer, Pocket & Office types
Tycos Fever Thermometers, Urinalysis Glaucometer

Booklets on Request

THE SIXTH SENSE OF INDUSTRY
Tycos Temperature Instruments
 INDICATING • RECORDING • CONTROLLING





THE CHEMIST'S MAGIC

AN EDITORIAL

MR. STEDMAN SMITH, of Audubon, N. J., asks for "the story of chemistry." No easy assignment, that! The story of chemistry is like an endless chain—it starts anywhere and keeps on going forever. But I assume Mr. Smith has in mind something that will make folks gasp with astonishment when they read. Let's try the day's reports.

An American discovers one of the five unidentified chemical elements, the fundamental building stones of matter, sought by scientists for centuries. A German makes silk from the wings of grasshoppers and the shells of crabs. An Austrian produces electric current from chemicals without the use of dynamos, machinery, or batteries. An Englishman makes sugar out of plain water and carbon dioxide.

If these announcements don't make you gasp, it is because your mind has become so accustomed to chemical miracles that you take them for granted. Chemical ingenuity, almost every day, produces something new for us to wear, eat, see or work with. A few exclamations greet each new product, and then most of us hurry along to the next marvel of science. But chemists can make, or will make, in their magic crucibles, everything that nature can make except, perhaps, life itself.

A HAMMER lies on my desk. It is a good hammer—the kind of hammer a competent workman uses. It is made of steel—a chemical product. Chemists have tipped the gold point on my fountain pen with a platinum iridium alloy to keep it from wearing out. And chemists have dyed the suit I wear with dyes they extracted from coal. The perfume the young woman who types this uses is made from coal, too. And she is wearing "silk" stockings made from wood cellulose, huge trees ground to chips, cooked and treated chemically.

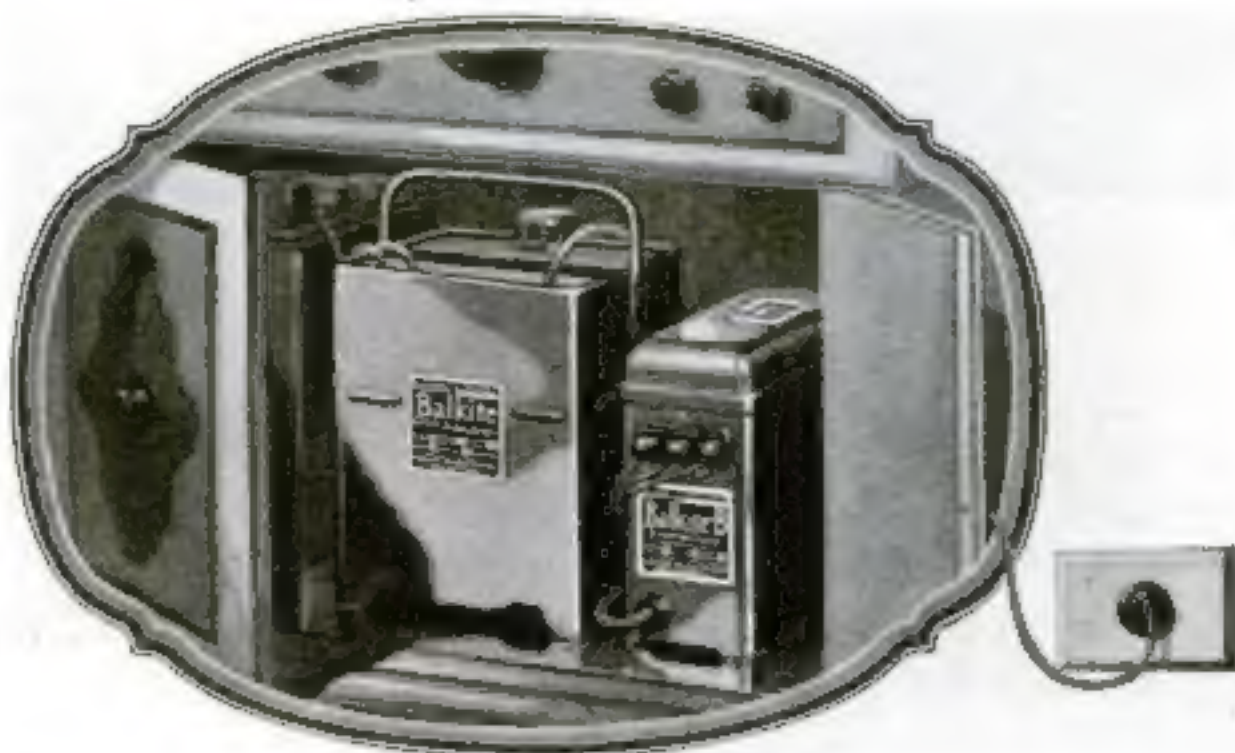
The radio editor cuts his finger. He paints the cut with a chemically produced liquid called collodion. Exposed to the air, it solidifies and forms a thin, tough covering for the wound. Photographic film has the same chemical base, and so, too, have the marvelous, new, quick-drying lacquers that do the work of paint and varnish. They harden almost instantaneously, and combine the protective properties of cotton packing and unbreakable glass.

I look through a pane of glass, made by chemistry from sand, lime, and soda, at an iron fence being painted red. Chemists discovered that iron rust itself will best protect iron against rust. So they mix iron rust with linseed oil to paint and protect fences, ships, bridges, and other iron surfaces. The automobiles running up and down the street are sold at modest prices because of a chemical product called "high-speed steel." Chemists add to ordinary steel tungsten and other uncommon metals, and with the resultant alloy tip metal working tools. These tools wear much longer than ordinary tools, and manufacturers of hammers and saws, automobiles and furnaces, radio sets and tractors, pass on the saving to us.

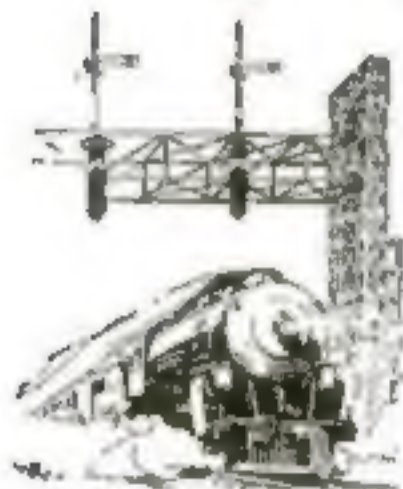
LOCKED in a single pebble is enough energy to drive the Twentieth Century Limited from New York to Chicago. Chemists are trying to release it. When they do, they may cut man's necessary daily labor from hours to minutes. For, with all that has been accomplished, we are just beginning in chemistry. We really know less of its enormous possibilities for the future than the kitten asleep on the oil driller's rig knows of the oil business.

And when we are tempted to feel impressed with our own importance, we have only to remember that chemists recently discovered that the average man is made up of enough fat for seven bars of soap, enough lime to white-wash a chicken coop, enough sugar to fill a shaker, enough iron to make a small nail, enough sulphur to rid a dog of fleas, enough magnesium for a small dose, enough potassium to fire a toy cannon, enough phosphorus for a box of matches, and a couple of buckets of water. You probably couldn't get a dollar for the lot in the open market.

IT IS a wonderful story, Mr. Smith, this story of modern chemistry. From coal tar, once a waste product, alone, we get poisons, drugs, flavors, dyes, and hundreds of other things we use every day. From its dozen primary products, chemists can build up thousands upon thousands of new and useful substances. To try to tell the story of chemistry on a single page is like trying to take an elephant out riding in a Ford. But you will find the story told, chapter by chapter, in the pages of this magazine, month after month.—S. N. B.



Balkite "B" and the Balkite Battery Charger give your radio set unfailing power from the light socket



*The Balkite
Railway Signal Rectifier
—Standard on over
60 Railroads*

In railway signal operation, where absolute infallibility is required, the Balkite Railway Signal Rectifier is standard on the signal systems of over 60 leading North American Railroads.

The method of charging used in railway signalling is practically the same as that used by the Balkite Trickle Charger with radio "A" batteries. At each signal is located a battery and a Balkite Rectifier which is connected to an AC current line. The rectifier is placed on permanent or trickle charge. It converts the AC current into direct current which is stored in the battery and operates the signal. The battery is always kept at full charge without attention.

This same method is also in use in many other industries. It is used for time recording, burglar alarm, fire alarm, emergency lighting, power plant control, substation control, instrument operation and telegraph and telephone battery systems.

In fact, there are no limitations for the use of this method. Wherever there is a battery and AC current, the Balkite Rectifier on trickle charge is ideal. It is noiseless, unfailing in operation, and has nothing to adjust, wear out or get out of order. Engineers, write for information.

With full, noiseless, even power, always exactly as required, your set will give you a quality of reception to be secured in no other way. Balkite "B" and the Balkite Battery Charger give you this power, with maximum convenience, from the light socket.

Balkite "B"—the noiseless "B" power supply—replaces "B" batteries entirely and supplies "B" current from the lighting circuit. Unlike any other "B" device, it requires no replacements and will not deteriorate with use. It will outlive 20 sets of "B" dry cells. With over 75,000 in use, on all types of sets, to our knowl-

edge not one has ever worn out. It is tested and listed as standard by the Underwriters' Laboratories, and guaranteed to give satisfaction.

The Balkite Battery Charger is the popular charger for "A" batteries. Its high charging rate makes it ideal for heavy-duty sets. Entirely noiseless, it can be used while the set is in operation. If your battery should be low you merely turn on the charger and operate the set.

Add these permanent Balkite Radio Power Units to your set and secure unfailing radio power from the light socket. Ask your dealer.

FANSTEEL
Balkite
Radio Power Units

Manufactured by FANSTEEL PRODUCTS COMPANY, Inc., North Chicago, Ill.

Sole Licensees in the United Kingdom: Messrs. Radio

Accessories Ltd., 9-11 Hyde Rd., Willesden, London, N. W. 10

Money Making Opportunities for Readers of Popular Science Monthly

Signposts TO A SUCCESSFUL CAREER

EVERY road has its signposts to guide the traveler. So, too, there are "Signposts to Success," pointing the routes others have followed to bigger pay and a brighter future. In this issue of POPULAR SCIENCE MONTHLY there are over a hundred of these signposts—MONEY-MAKING OPPORTUNITIES that you can't afford to overlook. You'll find them on pages 110 to 135.

YOU are ambitious. You want to be somebody, to win the worthwhile things of life—you want your success now—not in ten or fifteen years.

Then follow the "signposts to success" in the "Money-Making Opportunities" section of POPULAR SCIENCE MONTHLY—the advertisements of training courses, schools, and technical books that tell the quick, direct routes to better jobs at bigger pay. Every ad in this section points one way to succeed. Every ad is going to spell opportunity for some ambitious men. Will you be one of them?

AMBITION alone is not enough. You need training, too! Training will show you how to make the most of your ability and opportunities.

Training will enable you to avoid mistakes—to profit by the experience of others—to be ready for promotion, increased responsibility and increased salary when the time comes.

Training is the short-cut to success. Through study you learn the approved methods of handling your work, the latest developments, the best systems of co-ordinating your efforts and directing the work of others.

A few months of training will often give a man knowledge that he otherwise could gain only through years of picked-up, hit-or-miss experience.

LOOK carefully through the "Money-Making Opportunities" in this issue. See what others like yourself have done to win quick success. On page 110 you will read how a "drifter," getting nowhere, has in two short years become the owner of a garage doing a fine business. Another story tells the romance of success achieved by a sheep herder who became a building contractor and has accumulated a fortune of a quarter-million dollars. Still another story tells how a minister took a course in salesmanship to in-

crease his ability to "sway people with conviction."

What these people have done you can do! Read the Money Making Opportunities on pages 110 to 135 and decide which of the dozens of opportunities you will grasp for yourself,—which appeals to you most from the standpoint of your personal preference, your present position, and the openings in your locality.

If you enjoy working with tools, you'll want to write for full details about the books and courses on carpentry and building. If you like to sketch, the advertisements on cartooning, illustrating, and drafting will catch your eye. If your tastes lie along electrical or mechanical lines, or in the field of business, you'll find opportunities for specialized training in these vocations. No matter what work you prefer, you'll find "Money-Making Opportunities" that will help you achieve success.

POPULAR SCIENCE MONTHLY has made it easy for you to decide, by grouping all these announcements of training in one convenient section. Don't pass it by. Turn now to pages 110 to 135 and pick the "signpost to success" that you wish to follow!

\$100

IN PRIZES

for the Best Answers to the Question: "What Advertisement in the 'Money-Making Opportunities' Section interests you most and why?"

See page 110 for details.

The Road to Big Pay Is Open to You! See pages 110-135



one fourth as much current as in 1921

When you tune in today on a storage battery set, your Radiotron UX-201-A uses only one fourth of the current a storage battery tube needed just five short years ago. This means that you need charge your "A" batteries only about one fourth as often!

The present Radiotron UX-201-A is also a better detector—is a better amplifier—has a greater output—all on less current.

RCA research has produced better tubes—better methods of making tubes, to lower their cost—and better test methods, too. These improvements have come from the laboratories of RCA and its associates, General Electric and Westinghouse—laboratories devoted to year-in and year-out study of vacuum tubes.

The standard of quality back in 1921 was an RCA Radiotron. And the standard of quality today is an RCA Radiotron!

RADIO CORPORATION OF AMERICA
New York Chicago San Francisco

Radiotron UX-201-A

is the standard tube for storage battery sets. Radiotron UX-201-A is exactly like it, but has the old type base.



RCA Radiotron

MADE BY THE MAKERS OF RADIOLAS

Do YOU Want the BEST Too?

*"What is the best—"
is the Question the Insti-
tute is Most Often Asked*

"THE BEST" is what most POPULAR SCIENCE readers are looking for, if we judge from the letters received here at the Institute. We are asked over and over again to recommend the *best* radio receiving set, the *best* loudspeaker, the *best* battery eliminator, and so on.

A number of these readers have already put the same question to a friend and they report the friend's opinion to us for confirmation or denial. It seems to be invariably the case that the friend is able to recommend a *single* product as the best on the basis of his exhaustive (?) experience with several products or hearsay data gleaned from neighbors. The Popular Science Institute of Standards, after subjecting practically all the leading radio products on the market to laboratory and practical tests, is unable to do as much. Our conclusion, as a result of these tests, is that there is no one set, speaker, or other product that is definitely the best, and that can be so recommended to everybody.

A LETTER was received recently from a reader who was inclined to doubt the truth of this statement. He held the theory that the Popular Science Institute of Standards had very definite reasons for holding back such information as to the *best* products and that, if we were to be absolutely frank, we could very well limit ourselves to a single recommendation.

Whether this reader was entirely convinced by the explanation we gave him, we do not know, but the following is a sidelight that will be sufficient proof to most people of the sincerity of our statement.



He would not have such a hard time deciding if he knew the Popular Science Institute's opinion of the set.

As can be expected, persons intimately connected with the POPULAR SCIENCE organization who are in a position to realize the value of the Institute's advice, came to us for confidential recommendations. Do we recommend to them one set as the best? We do not. Different sets are recommended to different people and, except in rare cases where the prospective buyer has unusual requirements, not one, but several sets, are recommended.

This is the advice that is given to those on the "inside"; it differs not

the least from the advice that is given to readers. The Institute's records show that some six thousand people have followed its recommendations. They preferred to accept the opinion of an impartial authority like the Popular Science Institute, whose source of information is extensive laboratory and practical tests conducted at New York University, to the possibly biased advice of neighbors or friends.

THE Institute recommends only those products that it has found to be thoroughly efficient and that come up to the requirements for their respective price classes. A complete list of the products that the Institute recommends is available to the readers of POPULAR SCIENCE MONTHLY. No matter what product you select from this list, you can be certain that it is a good one, as the Institute's minimum requirements are very high. If you are in a position to purchase the best, select the highest priced products on the list. As all approved products have been found to represent good value, their prices give you the key to their comparative rating.

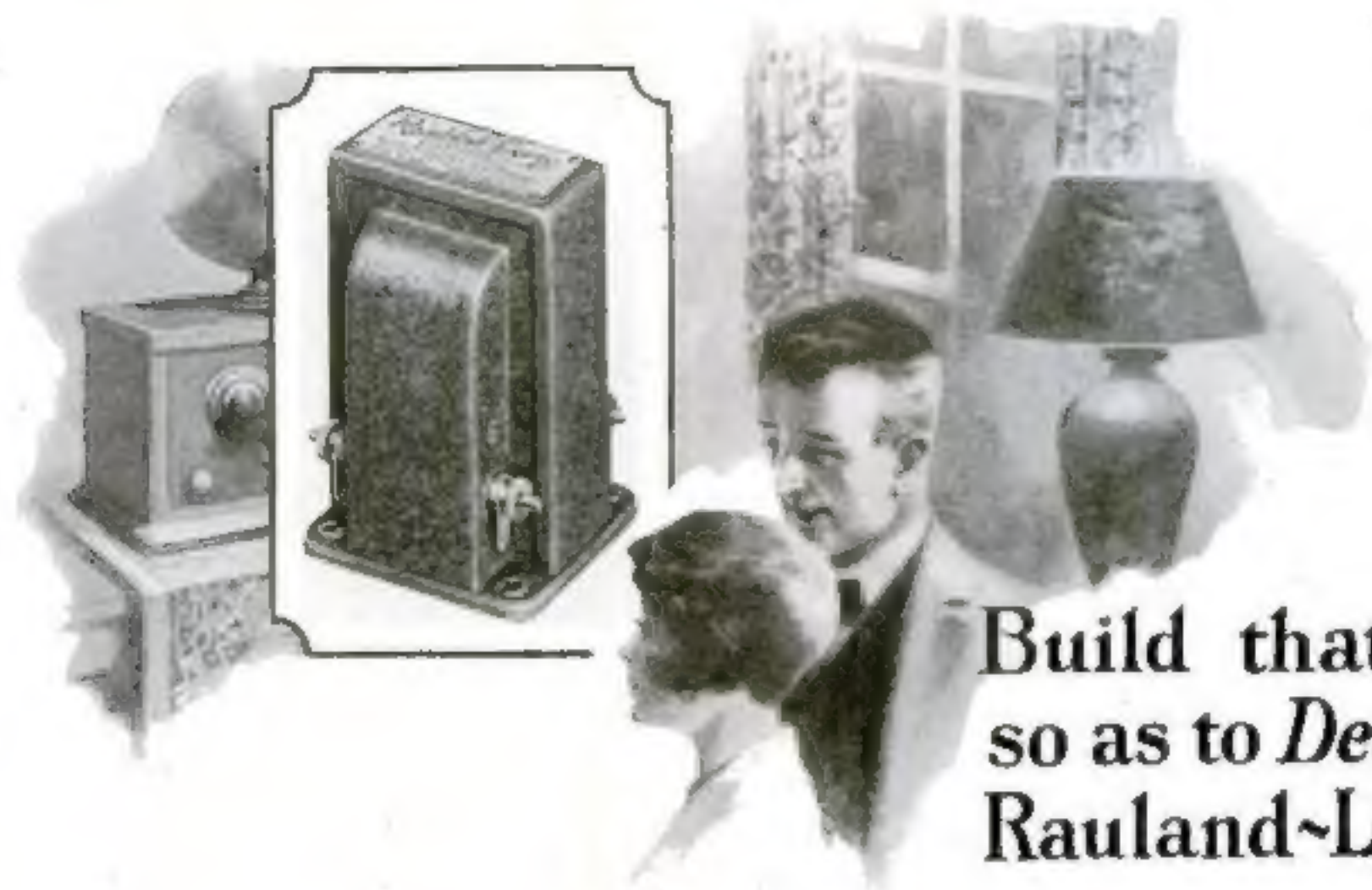
The list of radio and tool equipment that has been tested and approved can be had by writing the Popular Science Institute of Standards, 250 Fourth Ave., New York City.

Popular Science Monthly GUARANTEE

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

POPULAR SCIENCE MONTHLY guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in POPULAR SCIENCE MONTHLY may expect them to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by POPULAR SCIENCE MONTHLY.

THE PUBLISHERS



Build that Set so as to *Deserve* Rauland-Lyrics

Gone is the day of the jerry-built radio. Whether you build for use or for profit—one set or a hundred thousand—skimping on quality does not pay.

For the radio frequency stages, choose any good circuit and any type of coils you like—opinions differ. But, having chosen your circuit, be fair to it—let it show what it really can do—give it the benefit of Rauland-Lyrics.

As a man is known by the company he keeps, so is a set known by the audio amplifier which its maker deems it worthy of. Yet some builders, who would not tolerate the uncertainty of an open spring contact even in a battery circuit, will allow a dozen of them in a three-stage audio amplifier! Two stages, Rauland-Lytic-equipped, presenting no such potential trouble spots, assure ample volume for any speaker, with tone quality faithful beyond cavil.

Rauland-Lytic
AN

ALL-AMERICAN
TRADE MARK
TRANSFORMER

FOR THE MUSIC LOVER

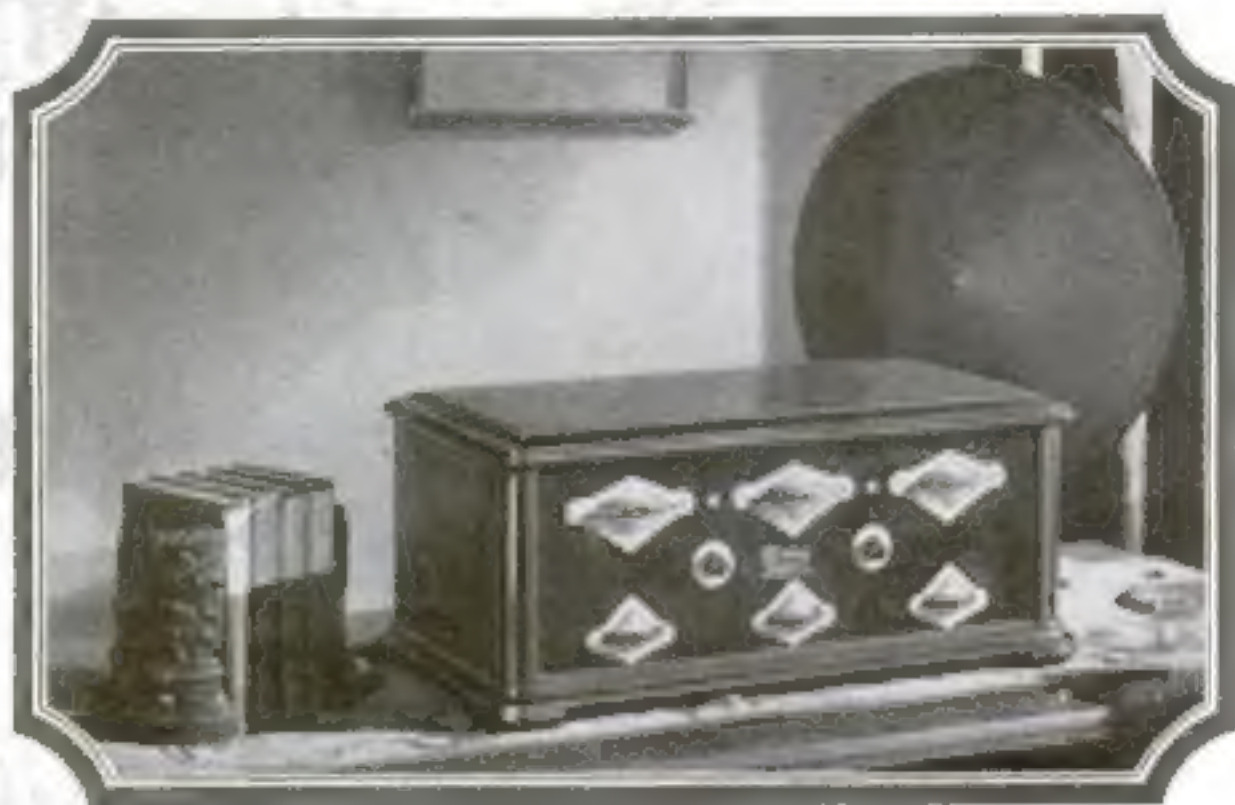
The Choice of Noted Music Critics

Rauland-Lytic is a laboratory-grade audio transformer designed especially for music lovers. The price is nine dollars. Descriptive circular with amplification curve will be mailed on request. All-American Radio Corp., 4215 Belmont Ave., Chicago, U. S. A.

©

ALL-AMERICAN
Radio Built for the Years to Come

OWNING AND OPERATING STATION WENR—265 METERS



The Practical Value of Superior Construction

OUT of the thousands of Grebe Synchrophase receivers sold during the past fall and winter, exactly seventy-three were returned to us for replacement or adjustment.

Isn't that about as near to 100 per cent perfection as human frailty can come?

The Synchrophase is built to give full satisfaction to its owner; its record shows that it does.

Ask your dealer to demonstrate the many exclusive Grebe features that, added to its sound construction, bring complete radio satisfaction.

A. H. Grebe & Co., Inc., 109 West 57th St., New York

Factory: Richmond Hill, New York

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.



"Where there is much merit there is great reward."

The merit of the Synchrophase has long been proven.

Grebe

THE GREBE SYNCHROPHASE

TRADE MARK REG. U. S. PAT. OFF.

This Company owns and operates stations WABC and WBOQ; also low-wave rebroadcasting stations, Mobile WGMU and Marine WRMU.



All Grebe apparatus is covered by patents granted and pending

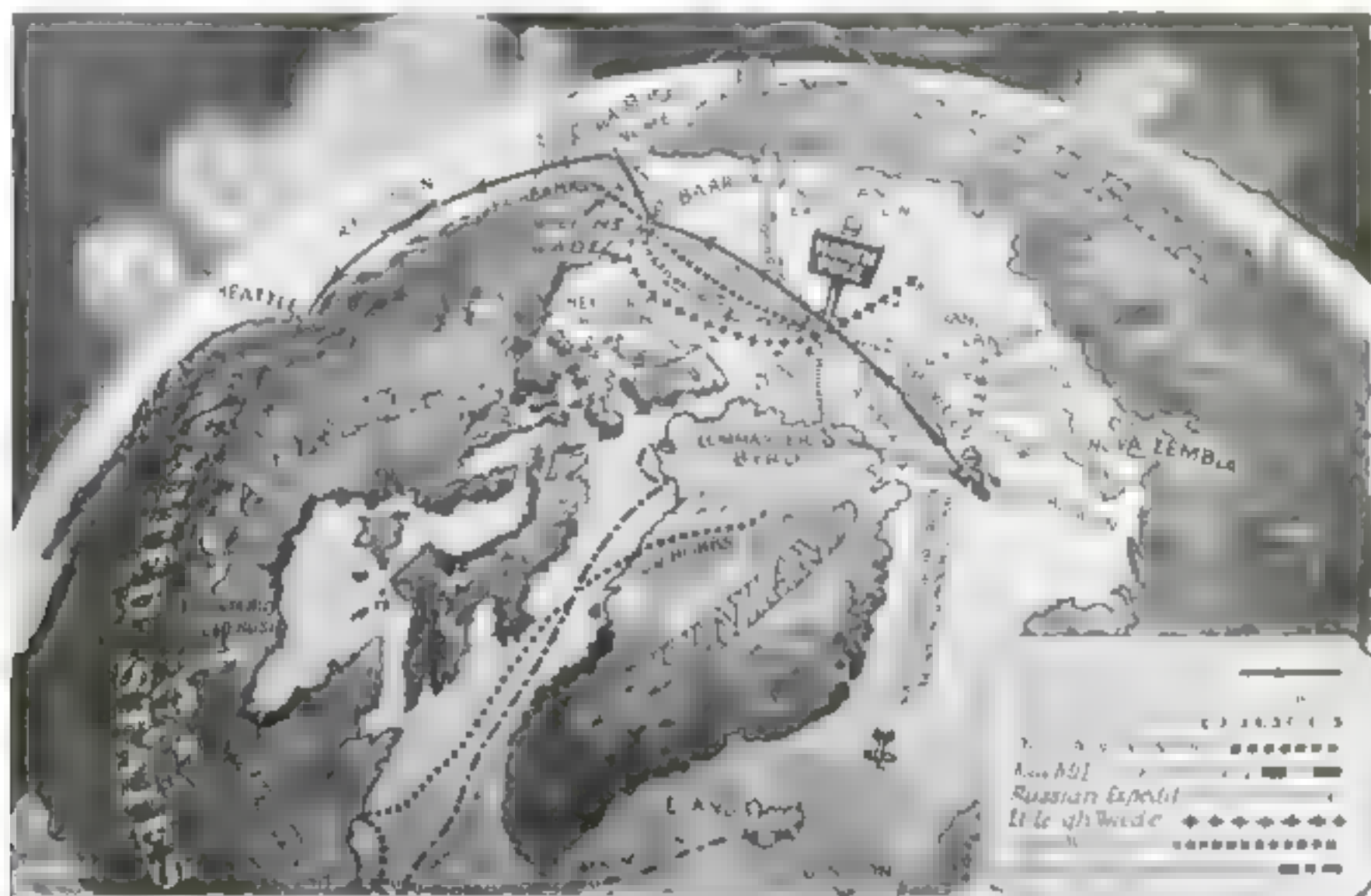




POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor

June, 1926



A bird's-eye map of the top of the world where men of many nations are joining the rush for discovery of new lands, new wealth, and new scientific knowledge. Routes planned by nine

expeditions are indicated, as is the scene of the latest gold rush in northern Ontario. A chief aim is the discovery of gold in the vast unexplored area between Alaska and the North Pole.

THE WORLD'S GREATEST ENIGMA

Marvelous Machines and Fearless Men in Stampede to Unlock Age-Old Mysteries from Grip of Polar Ice

By EDGAR C. WHEELER

AT THIS moment while the first warmth of summer sun melts the rind from our half of the earth there is in progress in the ice-locked fastnesses of the Arctic the most stupendous rush for wealth, adventure, and new discovery of modern times.

Into vast frozen deserts more desolate than the swirling wastes of Death Valley yet more challenging than the old-time portenture of the Yukon, fearless men are pushing their way, beckoned by the mysteries of the unknown.

For the Far North, one of the few remaining realms of mystery and romance is having its first great boom. From many corners of the earth eager youths and tried old veterans of the drifted trail alike are advancing northward, spurred by almost every conceivable purpose that impels ambitious adventurers.

Some are prospectors, seeking gold. Some are explorers who hope to plant

their nation's flag on fertile new lands. Others have visions of vast untapped natural resources in oil, coal, agriculture, and precious metals waiting to be developed for commercial use. Others are trail blazers, seeking new and shorter routes for world travel and commerce. Still others are scientific searchers for new knowledge of our earth and the life upon it.

From America, France, England, Russia, Norway, Italy, they rush toward the Pole—some dozen expeditions in the stampede. A few are "mushing" with time-tried sleds and dog teams; others are setting sail in ships. And voyaging with these are men who place their faith and their lives in the most marvelous conveyances and devices for swift travel conceived by a modern mechanical age. In air-

planes, dirigibles and motor sleds, they attack the grim barrier of snow and ice, guided by ingenious compasses and the eyes of radio.

What will they find? What will be their fate?

The thrilling thing about it all is that no one knows, or can begin to guess, the answer. It is this fascinating uncertainty that gives the greatest stampede in history its glamour and its romance. The blank expanse of the Polar pack is the riddle of centuries. It is still the world's great enigma.

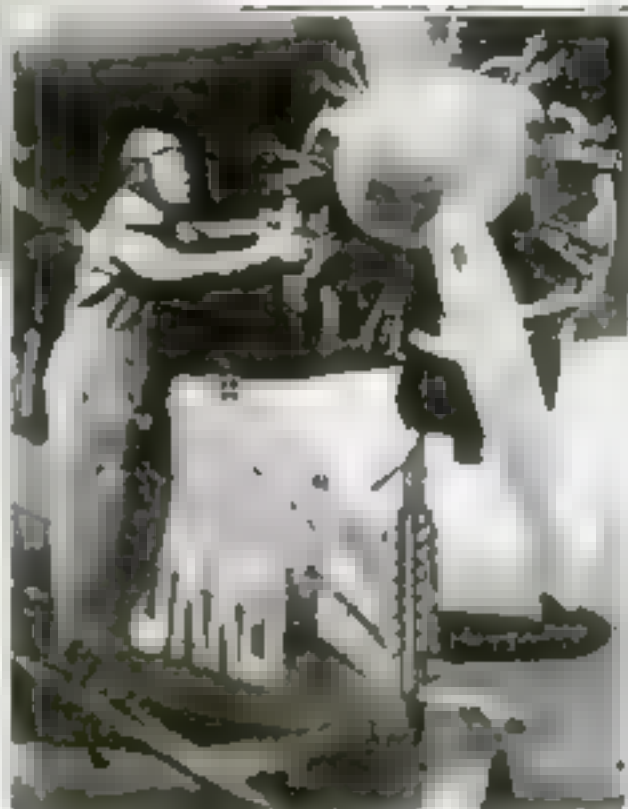
Will they gain the final conquest of the last great frontier? Will they, perhaps, discover a wonderful new Polar continent which ancient legend and scientific speculation say may be like a gem in the circle of nations bordering the Polar sea?

Perhaps they may reveal long hidden treasures of nature that will enrich the earth. They may uncover pay streaks of



Polar Birdmen and Their Machines

Captain George H. Wilkins (in circle) and Lieutenant-Commander Richard E. Byrd (right) both are counting on great triple-engine mono-planes to carry them over the 2,000-mile desert of treacherous ice in search of new land. Wilkins' machine is shown above taking off for a trial flight. Byrd, an expert mechanic and inventor, is seen at work making some pre-flight adjustments on one of the engines of his plane



gold that will outshine the richest strikes of the Klondike days. Possibly they may bring to light a race of men never before seen or known. Or they may answer puzzles that have baffled the greatest scientists—the mysteries of the Aurora, for example, or the secret birthplace of hurricanes that sweep down upon the lanes of commerce in the Atlantic.

They may open up opportunities now undreamed-of for our children. They may revolutionize world trade. They may plunge nations into another war of conquest. Possibly, even, they may change the whole course of modern civilization.

Who can say? Yet in these riddles lie the reasons that are luring at once the hardy explorer, the adventure-loving youth, the prospector for gold, and the man of science. Many of them are playing for big stakes—so big in fact, that great nations and men of great wealth are willing to finance their undertakings.

THE possible existence of a new Arctic continent is sufficient alone to spur nations in the race for possession, and to encourage stolid business men in the hope of new sources of wealth. Such a land would give its possessor a commanding position at the top of the world, within twenty-four hours' flying distance of any one of the great centers of population. It would provide the needed stepping-stone for an aerial trade short-cut across the Polar sea. In time of war it would offer a tremendous vantage point for attack.

And that such a land actually may exist is more than idle speculation. Studies of land formations and of sea currents, observation of the migration of birds northward, Indian legends, and reports of whalers whose ships have been driven northward in storms: all of these point to the likelihood if not the probability, of unbound Arctic land.

Any day this summer, radio may flash

the news of epoch-making discovery. On the other hand, it may bring us a tale of untold hardship, suffering and disaster unequalled in the annals of exploration. For of the men who are joining the stampede, some are playing against tremendous odds.

Flying in the face of the greatest peril are the half-dozen expeditions which are attempting to dash some 2000 miles across the Pole in search of the new land. Their goal, if it exists, lies somewhere in the midst of a million square miles of mystery—a vast uncharted "blind spot" lying between the North Pole and the northern shores of Alaska and Siberia. It is a wilderness of restless, jagged ice which continually opens cruel jaws,

treacherously and with little warning, to crush any who dare venture upon it.

These men trust to the miracles of modern machinery and invention to hurdle the barrier. At least four of the expeditions plan to take the hazardous chance of leaping across the frozen sea in airplanes. Three of them are headed by Americans—

Captain George H. Wilkins, experienced Antarctic explorer; Lieut. Commander Richard E. Byrd, U. S. N., who led the fliers in the MacMillan Arctic expedition last year; and Lieutenant Leigh Wade, famous round-the-world flier. A fourth airplane expedition is reported to have been organized by the Russian Soviet government.

Another air expedition is using instead of planes a semi-rigid dirigible, specially designed for Polar flight. It is commanded by the hardy Viking explorer, Roald Amundsen.

FINALLY, a sixth expedition will attempt to "mush" to the Pole and across the mysterious "blind spot," using a dozen remarkable mechanical "huskies"—strange motorized sleds with suction "paws" that grip the ice. This odd cavalcade will be led by Lieutenant Georges Darcis, a French sportsman.

In the race to claim new lands, two main bases of departure and destination, on opposite sides of the Pole, have been chosen—on one side Point Barrow, the northernmost tip of Alaska, on the other, the island group of Spitzbergen, north of Scandinavia. Wilkins and Wade have chosen Point Barrow as their hopping-off place. Amundsen, Byrd and Darcis journey from the opposite direction.

That the birdmen are taking a gambler's chance—that even the most smoothly running machines may not be proof against the treachery of the Arctic—already has been proved dramatically. Almost miraculously, Amundsen and his partner, Lincoln Ellsworth, escaped disaster a year ago when they were forced down in the ice pack in an attempt to fly to the Pole. This year Amundsen gives the airplane one chance of success in 1926. MacMillan, too, found that planes were not to be trusted entirely above the Polar sea. And the first of this year's



The New "Huskies"

On the expedition, mushing with the huskies, the Red Line gold fields, look aloft to see prospectors of 1926 whiz by in the air

What's Wrong in *This* Picture?

\$1,000 CASH PRIZES



JOHN and Mary Newlywed decided to repair and paint their side porch. The carpenter's cat mates came to more than they could afford so they set to work enthusiastically to do the work themselves. The

picture shows them putting on the finishing touches. What have they done wrong or what are they doing wrong? Also, what mistakes has the artist made in drawing the picture? See how many mistakes you can find

AMONG the thousands of letters that have come from readers who have entered one or more of our monthly \$1,000 Picture Contest, one of unusual interest arrived the other day. It was from a suburbanite, and it said:

"Dear Contest Editor:

"Here is my entry, such as it is. I have labored hard and long over the picture of John and Mary Newlywed, and in the end have succeeded only in gathering this handful of mistakes.

"Until now I had lived in the city all

my life. But I was married recently and my wife and I decided we'd like to try living in the country. Like John and Mary, we bought a small place, and thought it would be great fun to tinker around the house and fix it up ourselves. But judging from our poor success in finding the mistakes of the Newlyweds, I'm afraid it looks as if we were in for a tough time of it here.

The picture looks simple enough, but if we can't tell what John or Mary are doing wrong, how in the world are we

expected to know how to do things right?"

Two weeks passed. Then, one morning, there arrived another letter from the same reader including a second complete entry in the same contest. This time the list of mistakes was four lines as large as the first.

"Things are easier now," the letter said. "We have made some good friends in the neighborhood. They have been here a long while. The other evening, when we were visiting at their house, we showed them the contest picture. Right

away they spotted a lot of mistakes, and explained to us why they were wrong. As we worked on the contest together, we got to talking about houses and house-keeping, and as a result my wife and I learned a lot of valuable tips on what to do and what not to do in working about the place.

'Now we're both enthusiastic. We're having the time of our lives fixing things up. And for this we want to thank POPULAR SCIENCE MONTHLY and your 'What's Wrong' Picture Contest. By next month we hope to bring home one of the big cash prizes.

This newlywed is just one of hundreds of readers who have written telling us that they have found our unusual series of prize contest pictures depicting the experiences of John and Mary Newlywed in their home, not only entertaining but helpful as well.

The beauty of the contest is that anybody and everybody can work at it. It is simple. You don't have to be a skilled artisan or mechanic to have as good a chance as anyone of winning one of the valuable cash prizes listed on this page. And you can always get your friends, who

See If You Can't Win One of These Cash Awards

POPULAR SCIENCE MONTHLY is awarding \$1,000 in sixty-three cash prizes for the best answers submitted in this remarkable Picture Contest. The cash prizes will be distributed as follows:

First Prize	\$ 500
Second Prize	100
Third Prize	50
10 Prizes, \$10 each	100
50 Prizes, \$5 each	250
Total Prizes	\$1,000

may be more experienced, to help you. Take this month's \$1,000 picture, for example. It shows John and Mary painting the new porch they have built for their home. All you need to do is to study the picture carefully and see how many mistakes you can find - either mis-

takes made by John or Mary, or both, or mistakes made by the artist in drawing the picture.

In preparing your entry, simply write down the mistakes as you find them, on one side of a sheet of paper, telling briefly in each case just what is wrong and why it is wrong.

The \$1,000 in cash prizes, sixty-three in number, will be awarded to those readers who point out the largest number of mistakes, and who present their explanations of the errors in the clearest and most skilful way.

The judges will be Professors Collins P. Bliss and Hazen G. Tyler, both of the Popular Science Institute of Standards and professors at New York University, and Alexander Senauke, M. E., E. E., radio engineer of the Popular Science Institute of Standards.

First read the rules carefully, then go to work. You have until June 30 to submit your entry. Announcement of prize winners will be made as soon thereafter as possible.

And, of course, you'll be glad to know that another \$1,000 Picture Contest will appear in next month's issue.

The Rules of the Contest - Follow Them Carefully

1. Each month, until further notice, POPULAR SCIENCE MONTHLY is printing a picture of John and Mary Newlywed doing some simple job about the home. Each picture shows John or Mary, or both, doing one or more things in the wrong way. In addition, there are a number of deliberate mistakes by the artist in drawing the picture. You are to tell us what things are being done wrong and what things are drawn wrong in each picture, and why they are wrong.

2. POPULAR SCIENCE MONTHLY will award \$1,000 each month in sixty-three cash prizes for the best answers giving the greatest number of mistakes in the picture. These prizes will be distributed as follows:

First Prize	\$500
Second Prize	100
Third Prize	50
Next 10 Prizes, \$10 each	100
Next 50 Prizes, \$5 each	250
Total Cash Prizes	\$1,000

3. Prizes will be awarded to those persons who point out the largest number of actual mistakes found in the picture and who present their explanations of the errors in the clearest and most skilful way. Actual mistakes shall be construed in all cases to mean mistakes appearing in the picture about which there can be no question in the opinion of the judges. In case of ties, the full amount of the prize will be given to each tying contestant.

4. Answers to each picture must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the picture appears. Thus, to insure consideration in this month's contest, answers to the picture in this month's issue, published May 10, must be mailed or delivered

changes or corrections will be allowed in any entry after submission, but any contestant may submit as many separate entries as he desires.

6. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

7. You pay nothing. Just prove your knowledge and observation. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at public libraries free of charge. Each contest is open to everybody, except

employees of POPULAR SCIENCE MONTHLY and the Popular Science Institute of Standards and their families.

8. Officials of the Popular Science Institute of Standards will act as judges and their decisions will be final. Acceptance of these rules is an implied condition of each entry.

Another Contest in July

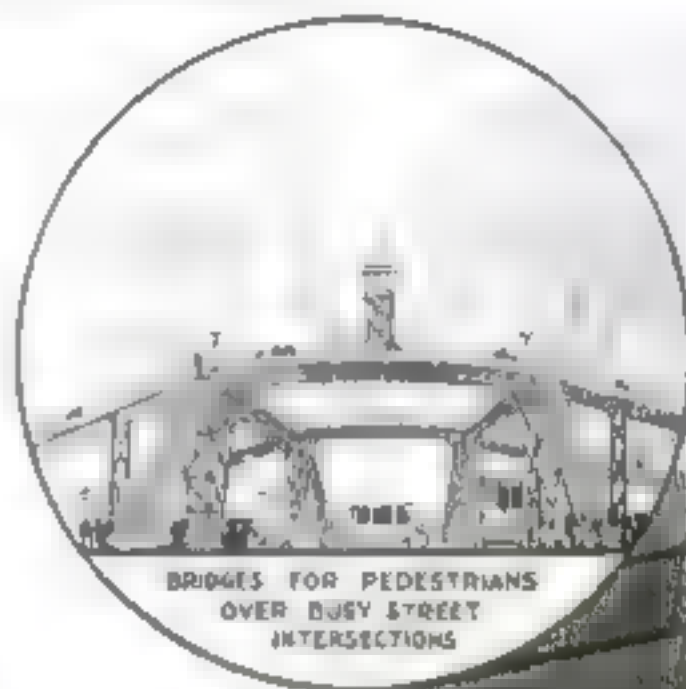
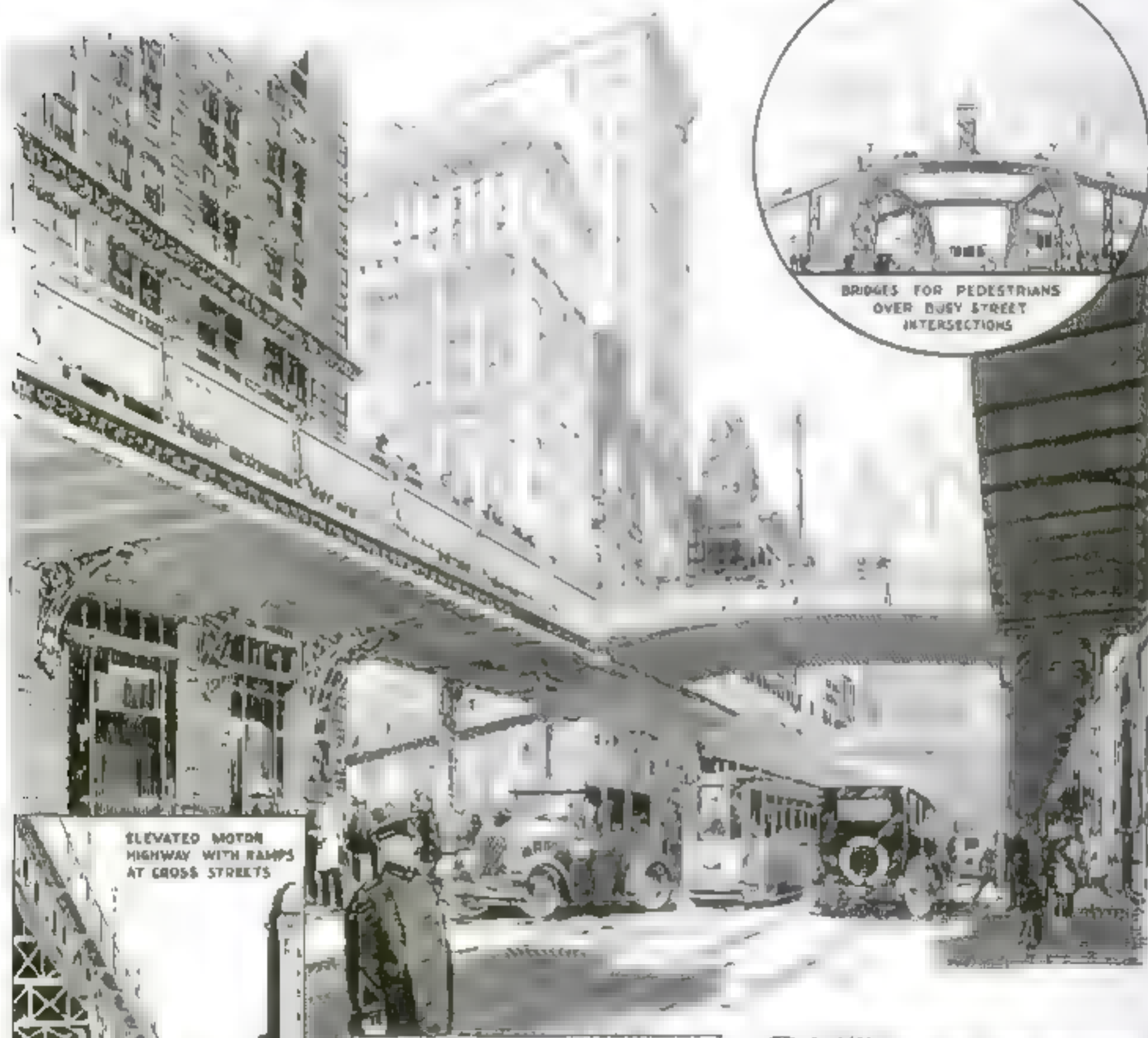
THE fifth \$1,000 Picture Contest of this fascinating series will appear in next month's issue. Watch for it. Other similar contests will appear in succeeding issues of POPULAR SCIENCE MONTHLY. Each will be a complete contest in itself. So, if you should fail to win a prize in one month's contest, you still have as good a chance as anyone else has to win one the next month.

not later than June 30. No entry bearing a postmarked date later than the closing date for entry will be considered.

5. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink and on one side of the paper only. Each error must be listed separately and numbered. No

As Our Traffic Gets Worse

*Two-Level Sidewalks and Motor Ways Proposed by
a Distinguished Architect*



An Actual Road-Cut View

By the author of "The City of the Future" and "The City of the Past"

His Reaper Feeds *the* World



"LET go of that horse!" shouted the high haired newcomer to Farmer Ruff. Then, as the angry farmer obeyed, the stranger turned to Cyrus McCormick. "Young man," he said, "bring your machine over into my field. I'll give you a fair chance to try it."

The Dramatic Story of a Boy Inventor Who Triumphed Where His Father Failed

By ROBERT E. MARTIN

IT WAS a harvest time holiday in a fertile backwoods valley of Virginia in the year 1832. Over winding dirt roads farmers from miles around, with their wives, children and slaves, rolled into the village of Lexington where, on this day, was to be staged an interesting event. "That boy Cyrus McCormick from over by Steeple Tavern" was to give a public show of his "crazy contraption," a mechanical reaper which, report said, could cut a stand of grain faster than half a dozen men with scythes!

Every one of the country folk had heard of Cyrus McCormick and his reaper. In fact, for years the persistent attempts of the youth and his father to build a horse-propelled contrivance that would harvest a field of wheat or corn had been a standing joke in the community. But now the machine was completed. Would it work? Today they would see.

It so happened that the field where the exhibition was to be staged was owned by one John Ruff, a burly farmer, as straightforward as his name. Other people might laugh at Cyrus McCormick. But he—he was for giving every young inventor his chance. Yes, sir! And besides, what if the machine should really work? Wouldn't he have his wheat cut into the bargain?

And so Ruff stood by and nodded his head wisely while the farmers gathered around the young inventor and his odd creation. White-haired old men cocked their heads, scratched their beards, winked slyly at one another, and joked about the machine.

But to all the jests and railery Cyrus was cold. He swung to the back of one of the team that drew the machine, and away it rattled. Immediately the spectators began to wag their heads knowingly

and say, "I told you so." For the field was rough, and the reaper bucked and bumped, cutting the grain only in patches and making a sorry show of itself.

It was too much for Farmer Ruff. Angerily he strode out, seized the bridle of one of the horses, and sharply pulled the whole outfit up to a dead stop.

"Look here, young fellow," he shouted, "you'll have to quit! You're rattling all the heads off my wheat!"



The Reaper's Predecessor

Before McCormick invented the reaper, the most improved harvesting implement was the cradle—a scythe with fingers attached to collect the grain and carry it to the end of the stroke so that the cut swath was neatly laid to the sun for drying. With this tool two acres was a good day's work for one skilled man.



The Inventor of the Reaper

Where other inventors are disheartened by failure and disappointment, Cyrus R. McCormick rode over every obstacle to achieve fame and fortune and to help supply the world with an abundance of daily bread from its fields.

Cyrus leaped from his horse. Trembling with mortification, he faced the rough man before him. And then, as if by magic, kind fortune strode to his rescue in the form of an imposing-looking man in high beaver hat, long-tailed coat and polished boots. He was the Honorable William Taylor, leading citizen and politician of the whole countryside.

"LET go that horse there!" the new farmer shouted to Ruff, then, as the angry farmer obeyed, he turned to Cyrus. "Young man," he said, "bring your machine over into my field. I'll give you a fair chance to try it."

He directed young McCormick to an adjacent field where the spectators followed in silence. There Cyrus, proud and jubilant, drove his machine up and down the level land, cutting the grain in clean swaths. Through the afternoon he worked, and by sundown he had cut six acres of wheat, a task that ordinarily would have required the labor of six men. Farmers who had come to scoff drove homeward in amazement.

The idea of the reaper had been born, some fourteen years before, in the mind of the father, Robert McCormick, a

skilled iron worker who mended tools and machinery and was somewhat of an inventor. In those days, if some neighbor had passed the McCormick place near Steele's Tavern in the small hours of the morning, he would have seen a light still flickering in a log-cabin blacksmith shop in the rear of the homestead. And if he had entered the cabin he would have found Robert and his nine-year-old son, Cyrus, hard at work on the reaping machine which was to take the place of hand-wielded scythe and cradle. Of all Robert McCormick's inventions, this reaper was the one dearest to his heart. His secret ambitions for it he shared alone with his son; for Cyrus had inherited his love for tinkering and was an eager helper.

AND so, while the village folk laughed at their pains, the man and the boy worked on side by side, month after month.

Their first machine proved a dismal failure. When Robert tried it out in his field, it mashed the grain flat and left it a tangled mass. The neighbors chuckled, but McCormick simply dug the clumsy invention into the junk heap, got out his tools and began anew.

Many years of experiment, and in 1831

two, was enthusiastic and ambitious. All summer he worked feverishly, and by the close of the harvest his new machine was completed. In appearance, it was as queer as his father's, but in operation it had been entirely transformed. The horse no longer pushed, but pulled instead. At the end of the row of reaping knives, Cyrus had arranged a curved dividing arm to separate the wheat to be cut from the wheat to be left standing. The knives, as they were pulled forward, also were given a slashing motion. To prevent flattening the grain, a row of fingers at the edge of the knife blades was to catch the stalks and hold them while they were being cut. Finally, the falling grain, lifted and straightened by revolving arms, was to be caught on a level platform and

his father and a country schoolmaster as partners, he started an iron furnace.

The business was beginning to prosper when the panic of 1837 struck the backwoods country. The firm went bankrupt, and the McCormicks lost everything they had except the homestead. To save that, brothers and sisters worked night and day.

PERHAPS it was because the McCormicks refused to be beaten that, in the darkest moment, fortune unaccountably turned in their favor.

Late one afternoon a dark bearded stranger pulled up before the homestead.

"I'm Abraham Smith," he announced. "Here's fifty dollars. I want one of your reapers."

Cyrus was surprised, but not too sur-



—and Today

The latest thing in modern harvesting machinery is the combine, which does the work of the reaper and the threshing machine. It is a thirty-five foot machine that can harvest a large field of grain in a few hours.

prised to deliver the machine on the spot. In like manner two more orders came that summer. Soon the whole country to the west began to order the reaper, and other orders came in quick succession.

Now the problem became one of manufacturing and delivering to keep pace with the demand. And, in those days, it was a staggering one. Buckles for the reapers were made forty miles away and carried in on horseback. There were no railroads to speak of. In all the United States there were fewer than 100 miles of track. It was harder then to deliver machines to Ohio than it is now to ship them to the interior of China. First they had to be transported in wagons to Scottsville, then by canal to Richmond, then reshipped down the James river to the ocean. From there steamers carried them around the tip of Florida and up to New Orleans, whence they were carried in river boats up the Mississippi and Ohio rivers. From river points they had to be delivered to their destination by wagon.

THESE were difficulties that might have baffled even the most aggressive of modern leaders in industry. To surmount them required a fighting man of high courage, immense self-confidence and tenacity. Cyrus (Continued on page 123)



Nearly a Hundred Years Ago—

The first successful horse-drawn reaper perfected by Cyrus McCormick in 1831. It embodied essential features of the modern reaper—vibrating blades, fingers to hold the grain, divider, revolving reel to bend the grain down upon the knives, and platform to receive the cut grain. It was capable of harvesting twelve acres a day, equivalent to the work of six men.

another reaper was ready for trial. It was a queer looking outfit. While a horse pushed it along from the rear, revolving rods were to whip the grain against a row of short, curved sickles fastened to an arrangement of upright posts. In high hopes, father and son hauled it into a field, whipped up the horse, and set it in motion. But again, instead of cutting, it matted and trampled the grain.

SILENTLY Robert viewed the sorry outcome of his labors.

"I'm through," he said abruptly. "I shall waste no more time."

"But, father, it *must* work," insisted Cyrus. "Maybe it will go if we fix it so the horse will pull instead of pushing."

"Impossible!" replied the father. "But go ahead and try."

Cyrus, now a strapping lad of twenty-

there raked to the side by a helper.

A brief trial in their own fields convinced Cyrus and his father that the goal was in sight. Throughout the winter Cyrus made improvements. He arranged for a team of horses to pull the machine, and when the next harvest rolled around he staged the public demonstration at Lexington, the outcome of which already has been related.

It was one thing, however, to impress a crowd; another thing to persuade them to buy reapers. Neighbors who gathered around the stove in the general store of an evening were far from convinced that it would profit them to use Cyrus McCormick's machine.

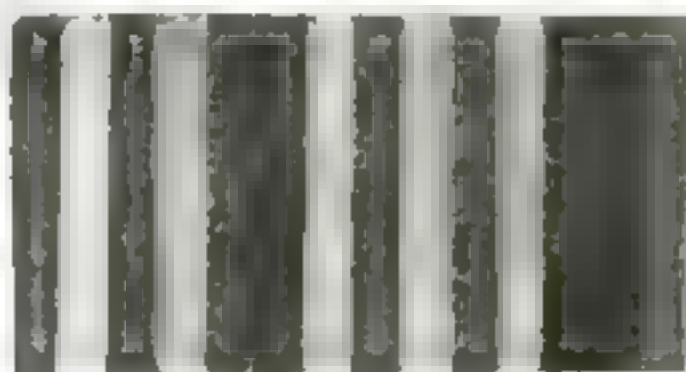
Cyrus realized that something more than the profits from the home farm would be required to finance the manufacture and sale of his invention. With

LIGHT—First Aid to the Movies



*If Your Eyes Are Blue
and Your Hair Blond,
Stay Away from the
Studio, Says Director*

By
D. W.
GRIFFITH



How the Camera Sees Colors

Chart shows how a variety of bright colors are photographed as varying combinations of black and white. Above, left, David Wark Griffith

MOTION PICTURE making is an art in which light is the first aid. All of us are sensitive to light, and the effects of color, which is one manifestation of light, are felt especially. In clothing some colors depress us, others lighten our spirits, some colors are restful, others tiring or exciting.

In their laboratories, scientists have found the reasons for this. They have measured light vibrations and tested their effects. Color and emotion, they tell us, are linked closely. Red, the most forceful and violent of colors, may stir ungoverned passion, anger, or even the desire to kill. Yet it quickens courage and is the hue of battle. Pink, with fewer vibrations of light, is thought to induce tender sentiment.

YELLOW warms and stirs you. Like red, its vibrations keep your courage at high pitch. Green is kindly and revivifying. Yellow crocuses, with their fresh green leaves reawakening an interest in life, play a great part in the sickroom.

Dressed in black, which absorbs all colors, unconsciously you take on new majesty of bearing. You feel the might of the accumulated light force. All these things, discovered in the laboratory, I have learned for myself in the studio. From the beginning of my career as a motion picture producer, I have tried to understand light and make it help me. To it I owe at least thirty-five percent of what success I have won in the cinema art.

"In the old Biograph days," as the period of my beginning as a producer is termed, I began my experiments with light. While I am not a camera man, I have always set the cameras for my pic-



Painting with Light

To obtain striking light effects for the screen, much apparatus is needed. In the lower picture the mirror is used to simulate sunlight through the trees; above, the battery of lights that produces "moonlight."

"Let's show their faces," I suggested. "It will be like an introduction to their characters."

The Biograph authorities at first weren't enthusiastic about my suggestion.

"They," the authorities told me, meaning the audience, "don't want to see their faces."

"No harm in trying," I said. So I set the camera close to the actor and turned it fully upon his face. The result, to my youthful spirit, seemed magical. Still the powers were doubtful. They offered the close-ups tentatively, and the applause that greeted them determined their fate.

IN THOSE same early days, it occurred to me that some remarkably beautiful and impressive effects might be obtained by setting the camera on a high mountain and registering the delicate play of light and shadow in the valley below. My technical associates scoffed at the idea. Yet I insisted. I took them to a lofty cliff. "The scene is there," I told them. "What the human eye can see, the camera also can be made to see. We have only to make the correct use of light under favorable conditions."

The first experiment in deep valley picturing was made with "Ramona," the pioneer of the two pictures of that name depicting the life of the Indian. In that picture, scenes in a valley an eighth of a mile away were (Continued on page 126)

tures. Perhaps because I was young I had from the first the hardihood to defy traditions.

I was the first to use the "reverse light." It had been customary to place the light behind the object to be photographed. I argued for placing it in front, and finally won a trial. The result was astonishing. Photographed with the light in front, the object seemed more natural. It looked as we are accustomed to seeing it instead of "like a picture."

My next experiment in the use of light was with the now generally used "close-ups," familiar to all movie fans today.

An Artist of Light and Shade

DAVID WARK GRIFFITH, author of this fascinating article, needs no introduction to our readers. It is a great pleasure to present this absorbing article, in which he tells how he devised many of the methods of production that have made the modern feature picture possible.

A Tug of War

How They Plan to Lift the Sunken Submarine S-51—The Most Daring Salvage Job in History

By L. U. REAVIS



Lieutenant Commander Edward Ellsberg, U.S.N. at the right, with the ingenious under water torch invented by him to enable divers to puncture the sealed hull of the S-51, as pictured above. An envelope of compressed air surrounds the intense flame.

AS THIS is written, the Navy Department is planning one of the most daring and ingenious salvage operations in maritime history—the tremendous task of raising the submarine S-51, rammed and sunk about fifteen miles off Block Island on the New England coast, in a collision with the steamship *City of Rome* on a dark night last September.

Manned by its ghostly crew of twenty-three dead sailormen, the rusty hulk of this two and a quarter million dollar fighting machine lies fast bound in sticky clay at the bottom of the ocean under twenty-one fathoms of water. For most the experts conceded that the wreck was a total loss—even the dead bodies never could be recovered. They said: "No ship of 1,000 tons displacement ever had been raised from such a depth as 130 feet."

How desperate attempts were made to raise the submarine and to rescue the crew by conventional methods and how these attempts failed, was described in *POPULAR SCIENCE MONTHLY* for December. Hope was abandoned when it was found that all compartments of the vessel were flooded.

THE reason these early efforts were unsuccessful was that the enormous cranes which tried to lift the S-51 amounted to only about 250 tons, or less than one quarter of the weight of the boat. Only the belief that the hull still contained large amounts of air spurred the rescuers in their frantic efforts to save the lives of their comrades.

When these first methods failed, it was obvious that an entirely new scheme must be employed if the S-51 ever were to be raised from its ocean grave. And so the Navy Department set quietly to work. Lieutenant-Commander Edward Ellsberg of the Construction Corps, an

engineer of long experience in salvage work, spent months studying the problem. Eventually he submitted a plan that was unique. Nothing like it ever had been tried before. And yet it gave every promise of success.

The difficulty of the problem may be realized when you find that the dead weight of the S-51 is not the only factor involved. Besides being completely water-logged, the hull is fast bound in a clay so tenacious that it had to be chopped away from anchors of vessels that had anchored in the vicinity. Just how much paid will be necessary to break the hull away from the grip of the clay is problematical. At a conservative rate, the total lifting power will have to be far in excess of the dead weight of the hull alone.

A remarkable cutting torch invented by Commander Ellsberg seems destined to play a vital part in the successful completion of the job. Torches of the oxy-acetylene and oxy-hydrogen type have long been in common use for cutting and welding steel. Commander Ellsberg has developed a torch of this type that will work with full efficiency under water. He has done this by supplying air under pressure in such a way that it forms an envelope around the flame from the torch.

To test out this torch, a tank sixteen feet deep was construct-

ed at the Brooklyn Navy Yard, where preliminary trials showed that the invention will cut steel under water almost as effectively as in the air.

At present a buoy is anchored by a long rope to the deck gun of the S-51. A diver from the *Falcon*, the principal salvaging vessel, will slide down this rope and land on the deck of the submarine. Other divers will follow.

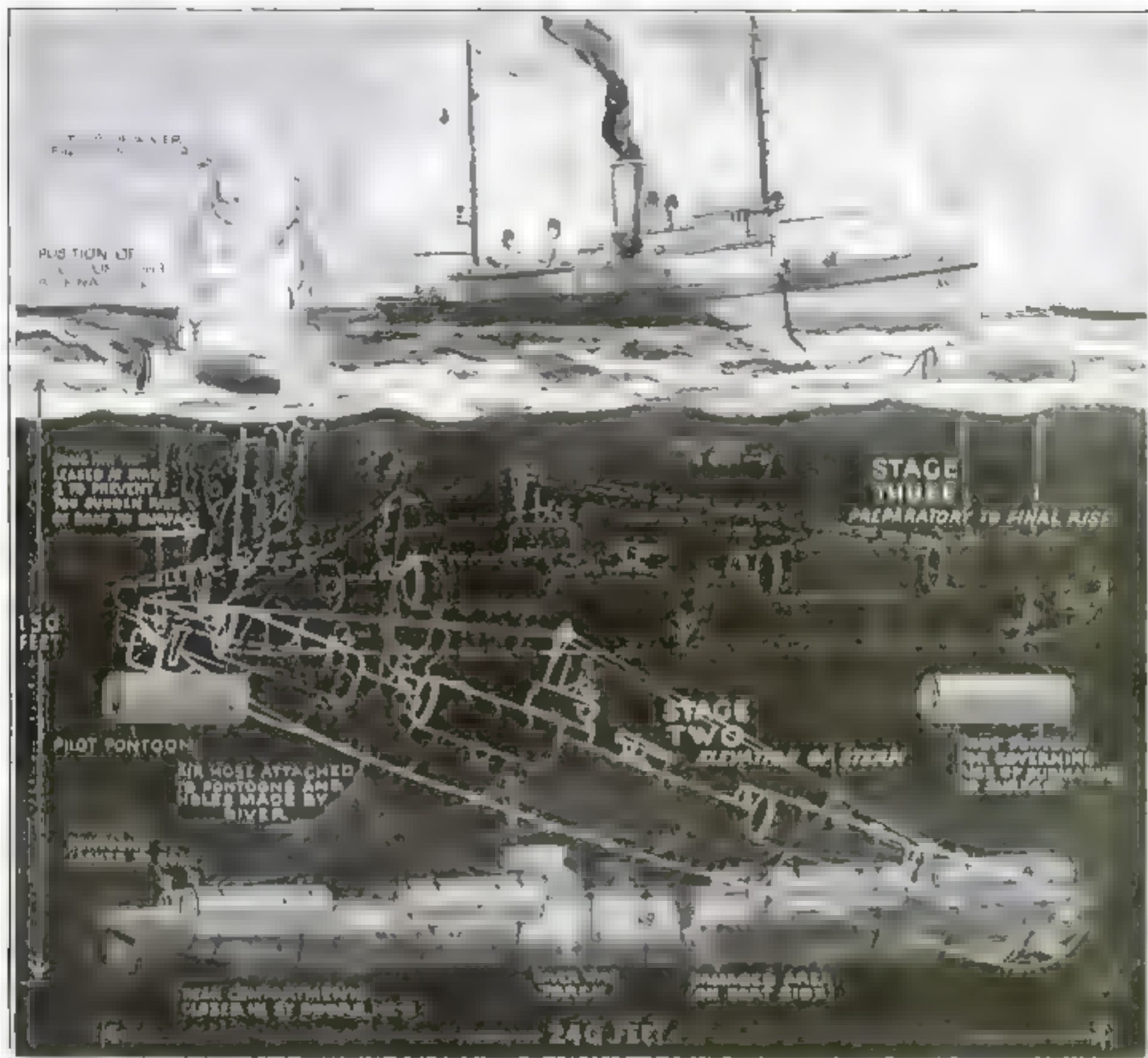
FIRST they will lash eight steel cylinders or "pontoons" to the sides of the wreck in tandem fashion. These pontoons are thirty-two feet long and thirteen feet in diameter. Each one will be fitted with a hose connected to air pumps on board the *Falcon*. When just the right amount of air is pumped into them, their weight in water can be made so little that the divers will be able to place them in position and chain them fast. Two more pontoons, eight feet longer, will be attached to the front and rear of the craft by chains about sixty feet long.



Dives in Tank to Test His Invention

Commander Ellsberg descending into a tank of water sixteen feet deep at the Brooklyn Navy Yard to test the practical working qualities of his new submarine torch.

with the Bottom of the Sea



The Ingenious Scheme to Raise the Submarine S-51 from Its Ocean Grave

IN THIS drawing, our artist graphically shows the three stages in the method to be employed in lifting the sunken submarine to the surface. It is expected that the combined lifting power of ten pontoons plus the buoyancy of the hull itself after air has been pumped

into it will break the S-51 loose from the grip of sticky clay that clutches it at the bottom of the ocean. The pilot pontoons are depended upon to halt the upward rush of the released hull at a depth of sixty feet until it can be leveled out by adjusting the air pressure

Meanwhile, other divers equipped with Commander Hilberg's under-water torch will be engaged in closing as many of the water-tight doors in the hull as possible, and in cutting ventholes in the bottom of the hull. Holes also will be cut in the hull at other points, and air hose lines from the *Falcon* will be fitted to them.

When these tasks have been completed, the divers will ascend to the *Falcon*, where the salvage crew will be waiting tensely for the final effort to float the S-51.

At the word of command the air pumps will be started. Gradually they will force the water out of the pontoons until they are entirely filled with air. The eight pontoons chained directly to the hull will have a combined lifting power of 760 tons, and the two "pilot" pontoons will add

120 tons of lifting power, making a total of 880 tons pushing steadily against the dead weight of the hull.

And then will come the supreme test. Air pressure will be applied to the hose lines connected to the hull itself, and it is hoped that sufficient water can be forced out to add at least 500 tons of buoyancy. Will this be enough to break the grip of the sticky clay?

If it is, the S-51 will surely rise with a rush, stern foremost, because the present condition of the hull appears to be such that the rear end of the submarine will hold air better than the forward end.

Such a sudden uprush is feared. It might imperil the entire undertaking if the S-51 should shoot suddenly to the surface, turn end up, and plunge beneath

the waves again as the air is suddenly released by the change in position. It is because of this danger that the pilot pontoons are used. It is hoped that as these pontoons reach the surface the sudden change in the lifting power available will hold the hull at the sixty-foot level until the men in charge are able to level out the hull by forcing more air in at the bow.

Commander Hilberg hopes that they will be able to force enough air into the wreck to bring it slowly to the surface, where it can be towed for 150 miles down Long Island Sound, through Hell Gate and down the East River to the Brooklyn Navy Yard, where it will be rebuilt and put back in service—a monument to the engineering skill and fearless enterprise of the United States Navy.

What Your Hand Tells a Palmist

You'll Enjoy Reading Your Own Fortune If You Don't Take It Too Seriously—What the Different Lines Mean

By WILLIAM J. WHITE, JR.

LISTENING in on the radio one morning recently I accidentally turned on a certain station. "Palmistry," a woman speaker was saying, "is an exact science—one of the oldest in the world."

I listened rather idly at first, but when the lecture was over my curiosity had been so excited that I made a resolve to delve more deeply into the subject to learn, if possible, whether palmistry actually had a scientific basis, as that radio speaker claimed.

That resolution has cost me much time and trouble, but I consider the results worth the effort. As to whether I have been convinced, you must judge. I will give a brief résumé of the subject, as the palmists present it, and a few observations of my own.

Just when the first man examined a palm and attempted to read character through its markings is not known. There is evidence that palmistry was practiced several thousand years ago in China, and the ancient Greeks and Romans are said to have given it considerable study.

PALMISTRY is divided into two sections, that are concerned respectively with the size and shape of the hands and fingers and with the lines of the palm.

Hold either hand out, palm up, and you'll be able to follow the nomenclature better. The fingers, starting with the index and ending with the little finger, are known as Jupiter, Saturn, Apollo and Mercury. These appellations are heritages from mythology. At the roots of the fingers will be found little puffs of flesh. These are called "mounts" and take their names from the fingers. Thus, under the index finger is the mount of Jupiter, under the second, the mount of Saturn, and so on. You will be able to see the mounts better if you close the hand slightly.



How to Read Your Own Palm

In this diagram we show the principal lines and mounts of the hand and the palmist's interpretation of their meaning. From the length or weakness of these various features as indicated by the diagram, you can read your own fate. Mr. White's article explains in detail how to do this very easily.

Now spread out your palm again so as to make the fingers bend backward. If that is possible, (I might observe in passing that if there is a perceptible backward tilt it is supposed to be a sign of great generosity and of very pronounced extravagance.) Take note whether there are slight rises or lumps at the joints. In palmistry, these lumps are known as the joints, whereas the sections of the fingers are called "phalanges." The first phalange is that containing the nail, the second, the middle, the third, that

nearest the palm. Now observe the palm. Several lines should stand out clearly.

First will come the heart line. This should start somewhere under Jupiter or Saturn—first or second finger—and run horizontally across the hand. Review that and almost parallel with it is the line of head. That generally has its beginning midway between the base of Jupiter and the thumb, and its ending under Apollo or Mercury. It may even extend over the side of the hand. Going back to the starting point of the head line, you'll discover a rather one hooked up with it for a short space but then branching off and describing a curve around the base of the thumb, ending at the wrist. That is the line of life.

THOSE are the three principal lines of the hand, and, if they are all present—occasionally the heart and head lines are one—you should have no difficulty in picking them out for their location is approximately the same on all palms. But the remaining lines are not placed with any such exactitude.

The line of fate is one of these. It follows a vertical direction, starting somewhere at the base of the palm and proceeding in the direction of Saturn. You may discover that it starts with the lower end of the life line. You may find it to the left or right of that. Or you may not catch sight of it until you have worked up the palm to the head line.

In some hands this line starts out well enough but breaks off at the head line. Or it may continue only to the heart line. All of these beginnings and endings have various significances, which I shall explain. I go into detail about this once, were you to be guided solely by a diagram on which the fate line was arbitrarily placed, you might be under the impression that you are futeless.

What follows seems to me a misnomer



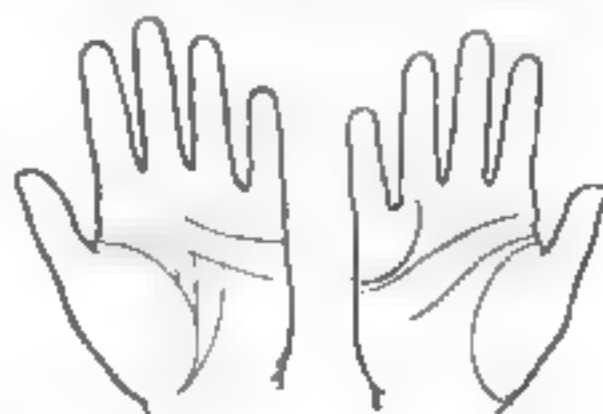
Cross on mount of Jupiter, a sign of happy marriage if affluence line runs across the palm.

Squares mean protection. These squares show recovery from illnesses indicated by breaks.



The girdle of Venus, just below fingers, in a bad hand denotes sensuality but in a good hand warm-heartedness.

The ring of Saturn, which is to be seen on the second finger, said to indicate a love of mysticism.



Vertical lines rising from the line of life are indicators of success in life, according to the palmists.

The line of fame or Apollo. When starting above heart line, as above, it becomes the line of notoriety.



The mighty left hand of Paul Berlenbach, famous pugilist. The fingers are massive—short and thick—those of a man of action. Only the rudimentary lines of the heart, the head and life are plain, as well as two "success lines."

Here the square palm denotes business ability; the long first phalange of Mercury a gift for oratory; the "Jupiter" line success. It is the hand of Joseph P. Day, the well-known vaudeville and real estate man.

Gloria Swenson has an almost ideal center or artistic hand. The long little finger indicates artistic ability; the square palm business capability; wide-spread fingers independence of thought. Fate, fame and head lines are pronounced.

—the line of health. As a matter of fact, it is just the opposite. Far better, say the palmists, if you haven't the line at all, since the more pronounced it is, the more ailments you are subject to. This runs vertically to the fourth finger, or Mercury, and is of variable length. It may start from center of palm or from the heart one.

The big lump at the base of the thumb (the section that is encircled by the life line) is the mount of Venus. Remembering your mythology, you can guess that this would be expected to have a great bearing on the affections. The mount of Mars, the theoretical seat of courage, fortitude, is on the outside of the hand just below the mount of Mercury, and the mount of Moon takes up where Mars leaves off and extends down to the wrist.

Hands are of three types—artistic, or cone; business, or square; elemental, or coarse. These are indicated by the shape of the hand and fingers, and are regarded as of extreme importance by palmists, since a line in the palm of one type may have a significance quite different from that of the same line in another type. Before I go into detailed description of these types, let me save you much perplexity by explaining that palmists say that rarely is a perfect type found. Virtually all hands are combinations.

Fingers are of three kinds—square, spatulate and cone, the shape of the tip determining the type. A square finger is, as its name implies, square on the end, a cone finger resembles a thumb, while a spatulate finger is spread out at the tip, not unlike an old-fashioned potato masher in miniature.

The square hand probably should be discussed first, since it is the most common. This is the hand, according to palmistry, of your sturdy citizen—the man who goes about his business in a quiet, determined way, obeys the laws, provides for his family, achieves material success, and is generally a credit to the community. Everything about him is square, including his character. His middle finger, or Saturn, in the ideal formation should measure the same length as the distance from the heel of the palm to the base of the finger. (That rule, as a matter of fact, applies to all ideal hands, no matter what the type.) If you want to find out how near you

approximate perfection, place the Saturn finger of your left hand on the palm of your right, the root of the finger resting on the heel of the palm. The tip should just reach the root of the right Saturn finger.

In addition, the hand has a square appearance, solid, substantial-looking. You can readily appreciate how this fits the square, solid, substantial citizen. Remember, however, you're not likely to find perfection, as I explained above. There'll be a mixture somewhere.

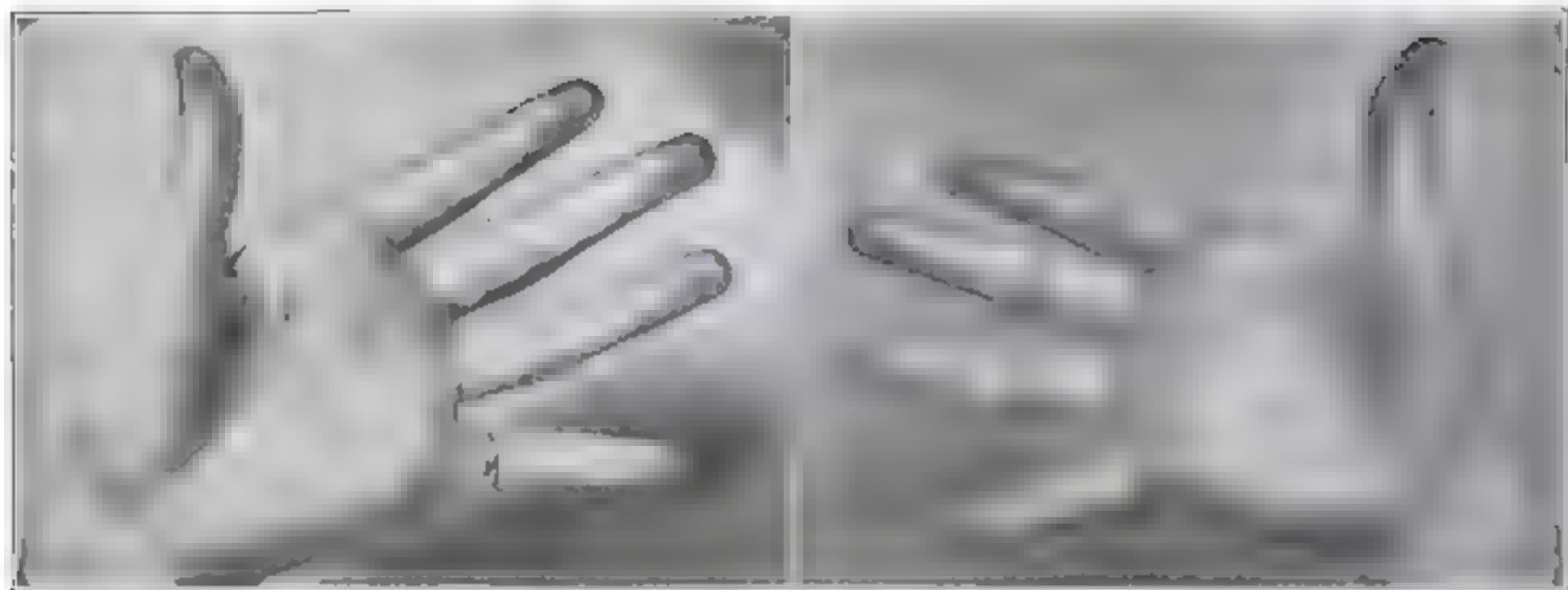
THE owner of the square type makes a poor lover, say palmists. He will be steadfast, a good provider, but unromantic. If his hand is especially square, he may be despotic, governed by reason to the point of fanaticism.

When someone mentions "artistic hand," what mental picture does that summon? Long, supple fingers, pointed at the tips, and thin palm, doesn't it? Can't you visualize those fingers racing across the keyboard of a piano or up and down the strings of a violin, or tearing madly through a great shock of hair to give vent to artistic excitement? Well, that's the artistic, or cone hand, exactly. The longer the fingers, the less order of mind, it is said, but the greater

Is Palmistry Really a Science?

POPULAR SCIENCE MONTHLY presents on these pages the results of an extensive investigation of palmistry conducted by William J. White, Jr., an able reporter. Scientists generally discredit palmistry and similar efforts to read character from physical characteristics. Dr. J. McKeen Cattell, former president of the American Association for the Advancement of Science, for example, asserts that such efforts are the "occupation of charlatans." However palmistry, little understood and fascinating to large numbers of people, offers many opportunities for entertainment, and Mr. White's clear, simple explanation is sure to interest you.

The Editor.



How a Strong Will Triumphed

A palmist, reading only this left hand—the hand of heredity—would see slight signs of mental development. The head line barely reaches the Apollo finger. Now examine the right hand on the opposite side.

Here the head line runs well across the palm indicating that the subject developed her mental strength through the exercise of the strong will shown by the well developed first phalange (upper joint) of thumb.

possibility of genius. The more pointed the tips, the greater the love of the artistic, the less the consideration for the materialistic. Carried to excess, this form may indicate mental instability according to palmists, or also a lover of luxury, an idler.

THE coarse hand is all that the name implies. The fingers are short—remember, this always means the length in comparison with the palm—they are decidedly spatulate, or club-shaped. The hand is hard, resisting. Here again, warn the practitioners of palmistry, is a fruitful source of error. A man's hand may be hardened through manual labor. This has no bearing on his character. When in doubt, the advice is to feel the sides of the third phalange of the Apollo finger. The skin there should have the texture almost of an infant's, as the fingers do not come into contact at those spots.

Refined, this type fills a very necessary place in the scheme of things. Its owner is the active, out-of-doors person, the explorer, the pioneer. Daniel Boone must have had such fingers, palmists tell me.

On the subject of fingers in general, length is said to denote intellectuality as well as a tendency to worry over trifles. Short-fingered persons, though, are quick in action and thought, and are not given to worrying.

In addition to the texture, the color of the skin tells a story to the palmist. White hands reveal to them the egotist; red hands show a hopeful disposition.

The thumb is regarded as the most important part of the hand. A good thumb can overcome bad tendencies, but a bad member will almost nullify good traits that show elsewhere. For that reason, after the palmist has decided the type, he generally turns to the thumb, which he believes is the seat of the will.

The first phalange of the



Art and business judgment are combined remarkably if palmists are to be believed in the hand of Edward Herbert Mayer, painter of animals. Imagination is shown by the well-developed first phalange of the thumb and



This Hand Governs a Great State

The outstanding feature of this hand is the well-marked heart line, sign of the "good mixer," according to palmists. There is also the squariness of the business hand, the long first phalange of Mercury denotes the orator—a strong will is shown in the thumb—there are an excellent head line and two distinct success lines. It is the hand of Gov. Alfred E. Smith, of New York.

thumb—that containing the nail—measures will power; the second, logic. When these are equal in length, the palmist is most flattering in his deductions. That, he says, is the ideal combination, as logic will balance will. If the first phalange is longer and is quite stiff, the subject will be found to be dogmatic, overbearing, one who will never confess error. Suppleness of the joint tempers this attitude somewhat. If the joint is short, the person is likely to lack resolution.

Given a good phalange of logic, a person who is not very strong in the will sector will have much good sense and judgment. His ideas in the abstract will be excellent, but he rarely carries out.

The palmist next determines which finger is dominant. To the beginner, this is somewhat confusing, but, after a number of hands have been examined, little difficulty is experienced. One finger in the hand will seem to stand out more than the others. In an unusually well-developed hand, this may not be the case. As I mentioned before, the model is a rarity.

JUPITER, according to the theory, is the finger of ambition. When short, it denotes the lack of when excessively long, an overbearing desire to rule. A desire for an exceptionally long Jupiter finger. Prudence and morality are shown in a normal Saturn finger; when too long, melancholy is indicated. Apollo is the seat of art, Business ability and eloquence. It is said are found in Mercury. The mounts are supposed to strengthen these attributes. Saturn long, combined with a large mount betrays the morbid, bitter person. It is well to bear in mind that over-development is never to be desired.

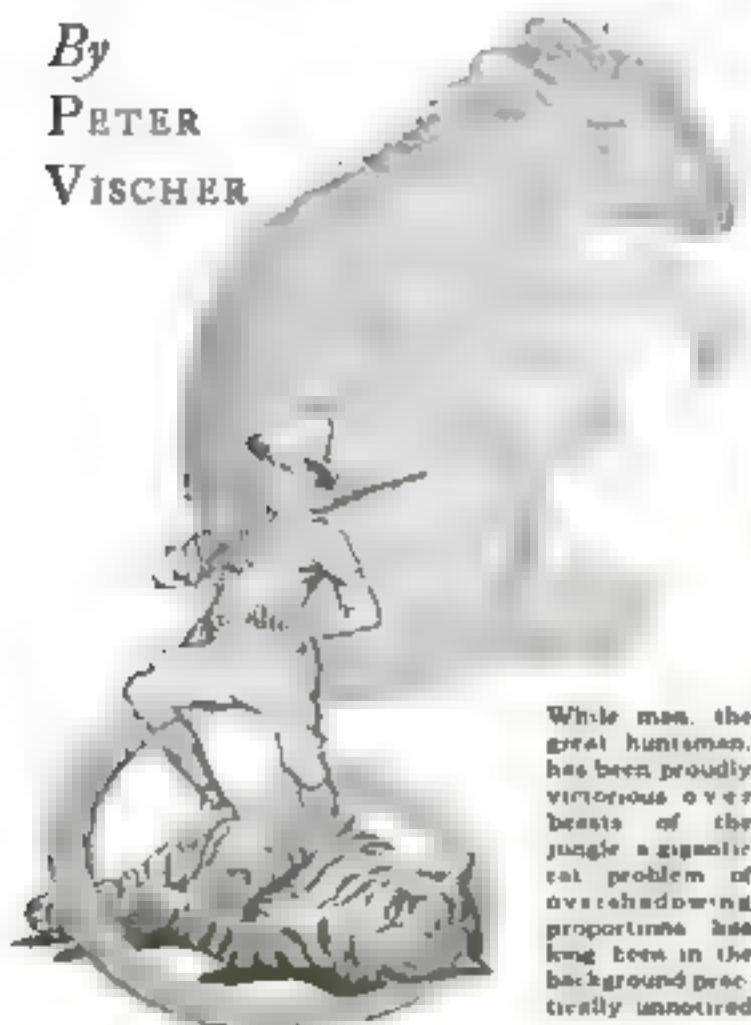
Palmists say that a tendency to keep the hand closed denotes secretiveness, and that secretive persons will reveal the trait, no matter how they try to conceal it.

In the New York subway the other day I saw two men engaged (Continued on page 130)

A Foe Man Has Yet to Conquer

By
PETER
VISCHER

How Scientists War against the Wily Rats, a Constant Menace to Health and Property—Strange Ways in Which They Outwit Us



While man, the great hunter, has been proudly victorious over beasts of the jungle a significant rat problem of overshadowing proportions has long been in the background practically unnoticed.

MAN, proud and arrogant, has long looked upon himself as a great huntsman. Wild beasts have been his prey from the days when he had no weapon other than a sling. He has been invariably fearless of animals, and has even made sport of their killing.

Lions and tigers have been comparatively easy victims of his hunting instincts, and today these fierce kings of the jungle are facing extinction. But where these great beasts have succumbed utterly and miserably, one far less majestic and far less heroic, the rat, grows stronger, bolder, and more numerous despite the unceasing attacks of the great huntsman.

This sordid beast, vile, unclean, abhorrent, apparently insignificant and unworthy of notice, is today an ever-increasing menace to man from the standpoint both of health and of economics.

The rat, declare those who have made a study of him, his habits, his depredations, is an organized enemy of mankind, disciplined like a soldier, fierce and warlike. And resourceful to a degree; clever, smart, keen, carefree, courageous, too.

THERE are people today, and probably always will be who believe that the rat problem is easily solved; that all you have to do to get rid of rats is to invite a lusty tom-cat to share your premises with you.

A classic tale among the huntsmen of rats comes to mind. The skipper of the British freighter *Ethelinda* had this idea. When he brought his craft from the west coast of Africa into New Orleans not so long ago, government officials, suspecting there were rats on board, announced they intended to fumigate with poison gas.

"It's totally unnecessary," protested the skipper, quite incensed. "I have a tom-cat with me, an exceptionally fine

tom-cat. A rat couldn't live on the same boat with him!"

Nevertheless, the *Ethelinda* was fumigated. And through the irony of fate, Tom was left on board in the excitement. But he was found again, dead—completely surrounded by rats. Twenty-four of them lay within five feet of their traditional enemy.

The problem of rat extermination is extremely important, and unfortunately is not easily solved. Scientists have been working on it for years and, though progress has been made, there is as yet no absolute solution.

According to Professor Henry H. Donaldson, of the Wistar Institute, the rat population of the United States alone is equal to its human population. This makes 120,000,000 rats, an extraordinary figure. And the United States is less troubled by these pests than are most other nations.

The common rat is not native to the United States, but an immigrant that arrived here 150 years ago. While the present-day rat population represents a large increase from the original colonial settlers, Professor Donaldson's experiments show that it is nothing to what might happen under "ideal" circumstances. A worker in his laboratory, from a single pair of albino rats, raised 3,800 in sixteen months.

PROFESSOR G. G. Chambers of the University of Pennsylvania has calculated that at the usual rate of one litter in four months and six young to a litter, in ten years the offspring of one pair of rats would, if all survived, number 2,300,000,000,000,000,000, or two and three tenths quintillions. Fortunately for the world, mortality is great among rats.

The rat is not only prolific, he is amazingly clever, quick-witted, ingenious, resourceful, and those who devoted their lives to his extermination have profound respect and admiration for him.

Dr. C. L. Williams, a surgeon of the United States public health service now stationed at Quarantine in New York Harbor, has been

studying rats in all parts of the world for more than fourteen years. He tells me he knows of no animal so extraordinarily adaptable. The rat lives anywhere, from the arctic circle to the tropics. He can eat anything. He colonizes. He gets fun out of life and enjoys his fellows. He knows his enemies.

For instance, Dr. Williams says it is easy to catch rats at first. When a new center of rats is attacked, capture and extermination is quite simple. This is illustrated by an experience Dr. Williams had in Porto Rico. A bakery there was thought to be so infested as to be the center of a plague infection. A wire fence three feet high was built about the place. And then its walls, of sun-baked brick a foot and a half thick, were attacked. Hundreds of rats ran out and, as they scrambled laboriously over the wire fence, poons killed them with clubs.

BUT rats learn quickly. And after the first of their fellows are killed, usually the others devise ways and means of escape. So there is no infallible means of extermination. Traps, simplest and most primitive weapons, are still the most effective. Poisons, rat (Continued on page 124)



How Wily Rats Outwit Man

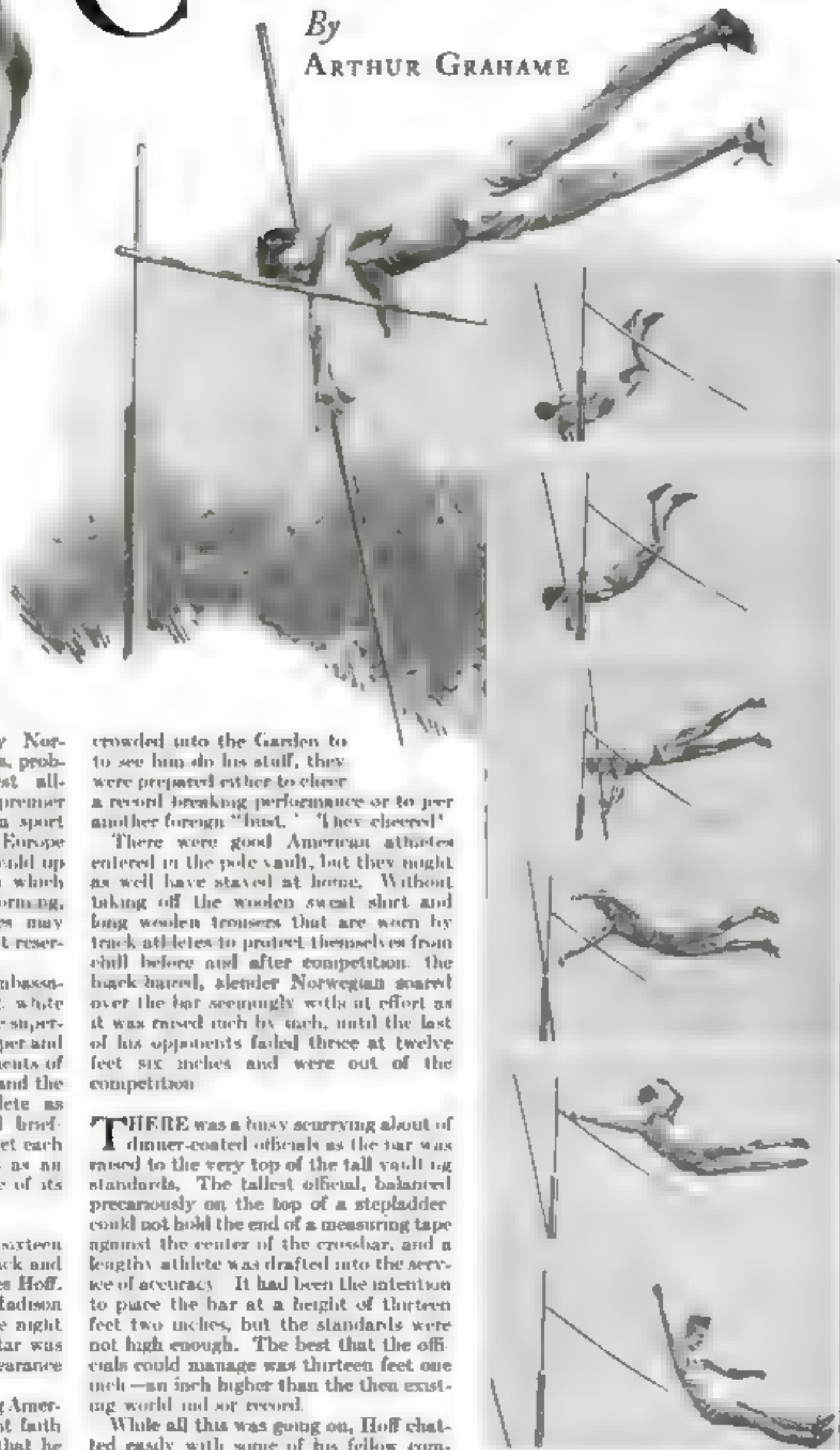
This drawing shows how a colony of rats outwitted a grocer who built a special stand to protect his eggs. By forming a living chain from stand to floor, they emptied the case of eggs in something less than an hour.

Charles Hoff, *the*

By
ARTHUR GRAHAME



From a sickly boy Charles Hoff has made himself the world's champion pole vaulter as well as the greatest all-around athlete of the present day.



These remarkable action pictures show the carefully studied "form" which has enabled Hoff to clear the bar at 13 feet, 9½ inches. As his pole nears the vertical position Hoff lifts himself over the bar by his arms alone.

CHARLES HOFF, possibly Norway's most versatile genius, probably the world's greatest all-around athlete, and certainly the premier pole vaulter of the universe, is a sport ambassador sent by the youth of Europe to the youth of America to help build up that unofficial league of nations which sport lovers the world over are forming, and into which the United States may enter whole-heartedly and without reservations.

This is the day of the sport ambassador—spiked shoes and glistening white silk running flappers may not have superseded wholly the gleaming silk topcoat and the Chester-frack coat as the garments of diplomacy, nor the tennis racket and the five-ounce glove rendered obsolete as diplomatic properties the locked briefcase and its sheaf of documents; yet each nation of the world now counts as an asset the good will bearing value of its star athletes.

IT WAS in the company of some sixteen thousand other followers of track and field sports that I first saw Charles Hoff. It was in the wonderful New Madison Square Garden in New York one night last winter, and the Norwegian star was making his first competitive appearance in America.

It is a peculiarity of the knowing American sport fan that he places slight faith in reputations won abroad, and that he is decidedly skeptical of all records made outside his own country. Hoff had for some years been heralded as the greatest all-around track and field athlete ever developed in Europe. When the fans

crowded into the Garden to see him do his stuff, they were prepared either to cheer a record-breaking performance or to jeer another foreign "hoax." They cheered!

There were good American athletes entered in the pole vault, but they might as well have stayed at home. Without taking off the wooden sweat shirt and long woolen trousers that are worn by track athletes to protect themselves from chill before and after competition, the black-haired, slender Norwegian soared over the bar seemingly with no effort as it was raised inch by inch, until the last of his opponents failed three at twelve feet six inches and were out of the competition.

THERE was a busy scurrying about of dinner-coated officials as the bar was raised to the very top of the tall vaulting standards. The tallest official, balanced precariously on the top of a stepladder, could not hold the end of a measuring tape against the center of the crossbar, and a lengthy athlete was drafted into the service of accuracy. It had been the intention to place the bar at a height of thirteen feet two inches, but the standards were not high enough. The best that the officials could manage was thirteen feet one inch—an inch higher than the then existing world and/or record.

While all this was going on, Hoff chatted easily with some of his fellow competitors. When all was ready, he stood at the end of the yellow pine runway, still clad in his shapeless woolen training suit, and gazed for a moment, very calmly, at the crossbar a hundred feet away.

One-Man Track Team

*The Remarkable Story
of a Sickly Boy Who
Became the Greatest
All-Around Athlete*

Then, balancing the long, tape-wrapped bamboo pole gracefully, he broke into an easy run that quickened to a swift sprint, planted the pole with nice precision, leaped powerfully, and without apparent effort soared over the bar with a half foot to spare. And then dropped lightly into the sand of the landing box, possessor of a new world record. That was Hoff, the athlete.

As the big crowd cheered, he jerked the gray sweat shirt over his head, shook his long black hair from in front of his eyes, and slipped out of his baggy woolen trousers. The band started to play the stirring Norwegian national hymn and Hoff stood at attention, his angled, marvelously developed body displayed to perfection by his smart silken track togs. That was Hoff, the showman.

Graceful, thoroughly at ease, sure of himself, he listened to the cheers with which New York greets a winner. Perhaps as he stood there—sixteen thousand pairs of admiring eyes on him, his thoughts wandered back across three thousand miles of ocean and the span of a dozen years to the head of Christiansfjord, where, white against the pine-wooded hills that rise steeply behind it stands the ancient Norwegian city of Oslo, which we Americans call Christiania, where a boy, too frail to join in the games of his schoolmates, looked on wistfully as they played.

For that boy's name was Charles Hoff.

THE next time I saw Charles Hoff it was in a pleasant room of the apartment of relatives with whom he spent his New York visits: a comfortable, livid-in sort of room with good etchings and a colorful oil landscape on the walls, chairs that invited you to sit down, a violin case in a corner, and a paper-backed Scandinavian novel lying open on a couch. Nowhere a sign of sport equipment; nowhere an indication that one of the world's greatest athletes used the room.

Hoff came in hurriedly.

"I am learning to drive a car, and I have been driving on Broadway," he said with some pride. "It is much harder on the nerves than breaking records."



As in athletics, this young Norwegian makes a success of every thing he undertakes. He is a journalist, novelist, actor, musician—and since he has come to America he has also mastered the Charleston.



Hoff's ability as an all-around track and field performer is hardly less marvelous than his skill as a pole vaulter. Many believe he can defeat any man in the world in an all-around test.

About Charles Hoff there is nothing of the professional "strong man." He does not punish the hand of the innocent acquaintance with a bone-crushing grip. The muscles that help to lift his body over the crossbar at unheard-of heights do not bulge the shoulders of a too light coat. Off the athletic field he is just a tall, loose-jointed youth of twenty-three, with a mane of black hair, eyes that seem black one moment and a deep blue the next, and long-fingered hands that might—and do—belong to an artist. Also, a wide and charming smile.

He dropped into a chair, crossed his long legs, and used the smile.

"Yet wishing to talk about——" he began in his excellent English. "Charles Hoff," I said.

HOFF laughed. "But which Charles Hoff?" he demanded. "There are several. I am what you Americans call a jack-of-all-trades. But mostly I am a journalist—a sports writer and cartoonist. That is my profession." He pointed to a portable typewriter on a table. "Even here in America I work at it."

"But," I objected, "you were an athlete before you were a journalist."

"Not not a very prominent athlete," replied Hoff. "When I was a small boy, I longed to run and jump and use my

body as other boys did, but my health was poor, and I could not do as they did. So I just envied them. Then, when I was about thirteen, I grew stronger and began to imitate them. I became interested in running, and it was as a middle-distance runner that I started my career while a student at Oslo University. I tried other events, too—jumping and hurdling, everything but pole vaulting. Always I have enjoyed trying to do various things. I even tried to be an actor after I had been graduated from the university and appeared in a dancing act in a theater in Oslo. But in that I was not too serious—it was a lark. Dancing is fun always—I have learned your Charleston." He uncoiled his long body from his chair and demonstrated that he had. Shades of Henrik Ibsen and Bjørnstjerne Bjørnson and the other gloomy geniuses of the land of the midnight sun! Here was a Norwegian who could not be accused of taking life too seriously.

BUT Hoff's eyes were earnest when he sat down again.

"In other things I have been more serious," he continued. "I have written a novel—a fantastic romance—and on that I worked hard. Perhaps some day it will be translated into English, so I will not tell you now." *(Continued on page 122)*

It Controls Speeders

Magnetic Device Automatically Reduces Speed to Safe Limits at Grade Crossings



Control Insures Greater Safety

Charles Adler, inventor, inspecting his magnetic control that automatically slows up speeding cars approaching dangerous spots in the road

A NOVEL and fascinating idea came to Charles Adler of Baltimore, Md., one evening as he sat by his laboratory window and watched the twinkling lights of the commuters' trains flashing by in the railroad yards far below. He contrasted their orderly, methodical operation with the helter-skelter rush of the home-going automobiles on the road that crossed the railroad tracks at the end of the yard.

"Why not," he thought to himself, "apply a little signal engineering to the problem of preventing auto accidents at grade crossings? Surely there must be some way to keep the reckless driver from committing suicide—force him to drive carefully whether he wants to or not."

The idea made a deep impression, and Mr. Adler set to work to solve the problem. After considerable experimenting, he has invented a system that automatically slows down the fast-driven car as it approaches the railroad crossing. No matter how hard the driver steps on the throttle, the car will not travel at a speed greater than fifteen miles an hour until it has passed the crossing.

THE little device that turns reckless drivers into careful ones in such peremptory fashion consists, essentially, of a powerful magnet concealed in a concrete box buried beneath the surface of the roadway at proper distance from the railroad crossing. As the approaching car passes over the magnet, it operates a small relay fitted in a metal box on the front axle of the car a few inches above the ground. The pull of the magnet momentarily opens a normally closed contact which is connected in series with the automobile battery and the coils of the selective relay placed in another box under the hood of the car.

The selective relay consists of two coils mounted on opposite sides of a pendulum which serves as the common armature for the two coils. Attached to one side of this pendulum-armature is a contact that closes when the armature is attracted to

one of the coils and opens when the armature swings to the other coil. When closed, this contact again forms the normal path of the current that operates the ignition of the car; and when it is opened by the pull of the magnet buried in the road way 25 feet or more in advance of the crossing, the ignition current is forced to travel through another contact that is attached to a speed governor so built that it will allow current to flow through the ignition system at speeds below fifteen miles an hour but cuts it off when the car is traveling faster than that rate.

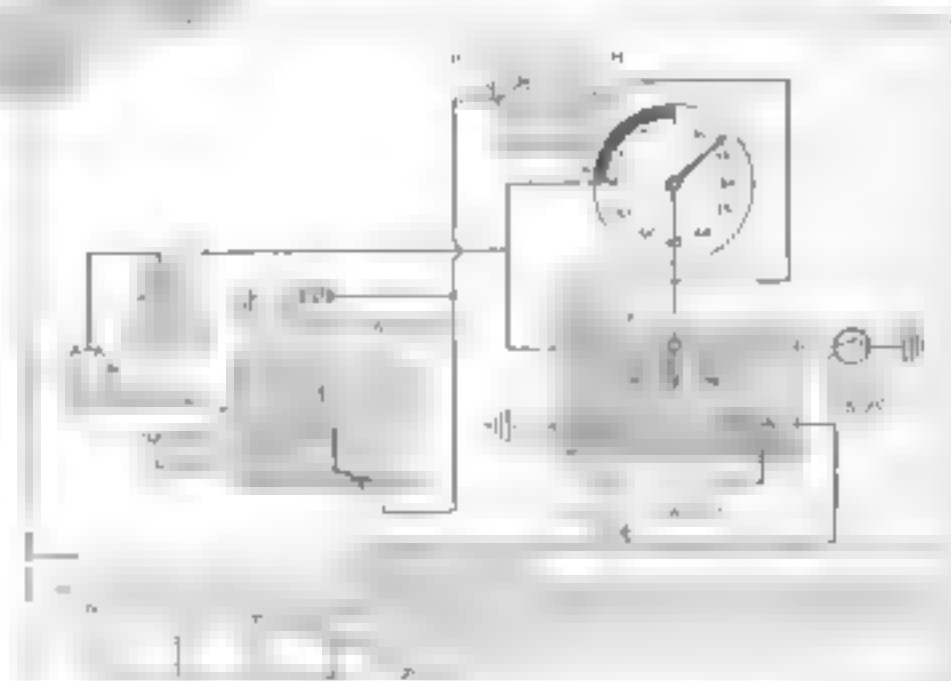
This action continues until the road magnet at the danger point is reached when another impulse is received that causes the pendulum-armature to swing back and close its contact, thereby restoring the ignition circuit to its normal path. The road magnet is made up of flat strips of magnetized steel, placed side by side in the concrete beneath the road surface.

And this remarkable invention may help to solve other important traffic problems besides that of the railroad grade crossing. Controlling magnets could be placed at any point where the slow and careful operation of automobiles is necessary for the public safety.

Dangerous road intersections, streets on which schools are located, bad curves, and even steep down grades could all be arranged for automatic speed protection. The automatic control of car speed in going down steep and dangerous hills



How the device works on a road with a treacherous grade crossing. Note control magnets



The Construction of the New Safety Device

Wiring diagram showing the working parts of the magnetic automobile control, and the method of burying the magnet in the roadbed

could be effected by an additional attachment which would apply the brakes as well as cut off the ignition while passing through the slow-speed zone.

SCHOOL streets are usually dangerous only during the time when the children are going to or from school and during recess periods. It would be entirely practical to use electromagnets buried beneath the road, instead of permanent magnets, and the current flow through these magnets could be controlled by the master clock in the school so that, as the recess bell rang out and the children flocked to the streets, all autos would be compelled to slow down.

The same idea could naturally be applied in cases where slow speed is necessary in the daytime during certain hours but is not needed late at night or on Sundays.

DO YOU suffer from the summer heat? In next month's issue will be published a helpful article on keeping cool in hot weather, prepared from the prize-winning contributions made to our Hot Weather Hints Contest.

It's a Wise Man Who Knows A Real Antique

How skilled workers give new furniture signs of age and wear—
They even raise worms to bore holes in new wood—Signs you
should look for when you buy—Confessions of a "distresser"

As told to G. B. SEYBOLD

MY JOB is faking antiques. It's part of the game of giving the public what it wants. In all Europe there aren't enough castles, palaces or ancient houses to hold the antiques that have reached this country in the last ten years. As for American colonials of all the pieces in the United States at present were genuine, the early American houses would have been crammed to the doors with chairs, tables and chests of drawers. And so would the barns.

Nowadays the first thing everyone wants when he starts to furnish a home, whether it be a tiny apartment or a twenty-room house, is a genuine, worm-bored, age-stained antique, with cracks filled with the dust of centuries.

To meet this demand, there are three kinds of antiques generally sold. There are the genuine old pieces, untouched in perfect condition, rich and rare, which command a high price and are seldom hard to dispose of. Then there are the restored pieces made in whole or in part from broken antiques. The missing or too badly damaged parts are replaced by bits from incomplete articles of the same type by skillful cabinetmakers who at times transform one article of furniture into another. They make, for instance, an antique desk from a real antique chest. These are really antiques but are not genuine.

The third type consists of new furniture which is given an intensive treatment of aging, also known as "distressing" to give it the appearance of antiques. These, of course, are not antiques but since there are not enough of the genuine articles, and some people must have antiques, we have to make them.

MY PARTICULAR job is "distressing" new furniture—hammering and knocking it to give it the wear of time. This is not so easy a task as it seems. The smallest mistake may make

all your work useless. In high-class "antiques," such as we carry, you have to satisfy not only the average person but people who go in for furniture as a hobby. They read books and talk with collectors until they know just what signs of age to look for. If our work is to pass muster, it is up to us to supply those signs.



The Fine Art of Faking Antiques

Putting the marks of age and wear by filing, denting and staining on a new library table. Hammering with a mallet or better still, vigorously banging with a good heavy chain, sometimes produces the effect of extraordinarily rough usage.

We get brand-new reproductions of ancient furniture direct from the factory. They are all made of good, well-seasoned wood, for with all the labor that has to be put on antiques, it wouldn't pay to experiment with cheap stuff. And we begin our work.

We first go over every square inch of a piece, wearing it down with a rasp or half-round file to give it the look of a well-worn article. Wherever there naturally would have been wear we dig the spots out first with a small hand ax and then with different sizes of files until there are little hollows such as hands or feet

would have made. This may not seem important, but it is. A woman looking at a refectory table the other day in our showroom pointed to the stretcher or crosspiece connecting the legs.

"Look, Herbert," she said, showing off her knowledge of antiques, "see the feet marks. You know this piece across here

was put on just so people could set their feet on it and keep them off the dirty floor of rushes that they had in those early times. Just see how it is worn."

I was glad that she appreciated it. I had spent hours getting that effect.

IN GIVING an article the appearance of hard wear, however, you have to be careful not to overdo the thing. If you put a nick in the edge of the table on one end, you mustn't make the mistake of balancing it with another in a corresponding place at the other end.

To get the natural effect of long use we usually wear down the right arm of a chair more than the left, because the average person leans more on his right elbow than on his left. And we round off corners in just the way persons brushing past them or grabbing them to move them about would have rounded them.

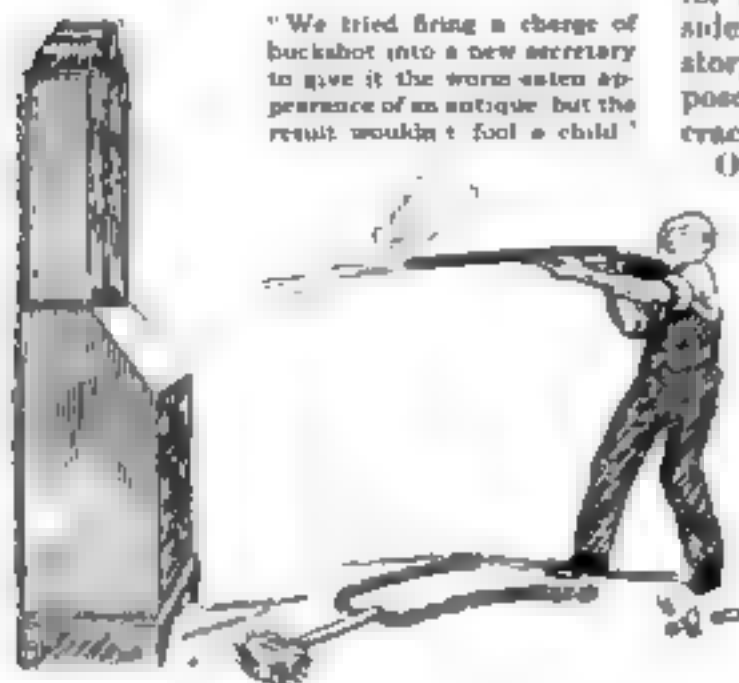
If there is carving on the table, we make signs of wear just where the brass naturally would have been

pecked up in ordinary usage.

Edges and corners of drawers we make round but a bit uneven, as they would have been if pulled in and out for centuries. A trilling thing you may say. But no! One day recently a dealer came in to look at a Queen Anne highboy, but he wouldn't take it because the corners of the drawers were all evenly rounded. No one ever uses the bottom drawers of a chest as much as the top ones, he remarked, quite correctly, and if this were a real antique the top drawer edges would be worn off much more than the bottom. He was too smart, that fellow, but it

shows you cannot be too careful. A tiny point overlooked leads to a big discovery.

As part of this aging process, keyholes are enlarged around the locks and hollows put in the backs of chairs with headpieces. Where do we get our ideas for all these steps? We simply watch the way people use furniture now, and then we think up a few extra things that might have happened to it when it was supposed to have been doing duty. For instance, if the piece is supposed to be of the time when men wore swords, and might have scratched tables accidentally with them, we naturally add some sword scratches. Clyde, who works with me, has a good



imagination. "An iron helmet fell on this corner," he says, giving a table a bang with a mallet.

Then, furniture that must have seen extraordinarily rough usage must be thoroughly scarred. For unimpressive scars, there's nothing better than a short piece of good heavy chain for beating the piece again and again. The dents it makes are rounded and uneven. A stone tied in a piece of canvas makes realistic scars, too, and an old pin iron picked up in a junk store gives good service for distressing.

And of course an antique would not be an antique, if it didn't have its quota of wormholes. So we put them in. There are many ways to do this. My favorite is a block of wood with heads of fine nails embedded in it and the ends sticking out. From the outside, the worms themselves couldn't tell the difference between their work and mine, and that's all we have to worry about with most people. Another tool that we use sometimes has a heavy head covered with spikes, that looks like the clubs you see in pictures of cavemen. A blow with this punctures wood with bigger wormholes than our homemade nail block. Experts say, however, that such "wormholes" are easily detected because they are straight, while worms work in spirals. On elaborately careful jobs they use real worms which are raised for this purpose. This worm raising forms a small industry in Italy.

THESE are the usual ways of getting the wormhole effect. But the other day the boss sprang a new one on me. He brought in a B-B gun.

"Try this on the French secretary," he said to me.

A new man had told him that in the

last place he worked they got fine wormholes with buckshot, so he decided to try it out.

So I set the secretary against a wall, took the gun, and fired. But it was a poor idea. The holes made wouldn't have convinced a child. We had to scrap the secretary.

Wormholes are made only in soft woods, because worms rarely bother hardwood. That's one reason why it is easier to make Italian and French antiques than English. The French and Italians used soft wood and the English hard.

No detail must be overlooked in faking an antique. If a piece was worm-eaten, for instance, and the veneer on the outside was good, that would tell the whole story. So when a veneered article is supposed to be antique, the veneer has to be cracked or split.

Often chips are cut out and little bits are glued on like mosaic, as if pieces had been lost and had to be replaced. In large patterns, such as a crotch walnut, quite large pieces can be stuck on. Sometimes buried pieces are trimmed with bandings of straight grain. That gives us a chance to put in extra pieces in the corners.

"We had to patch this in the corner, here," the boss tells the customer, who is convinced it is old because it had to be mended.

When the outside is properly antiqued, the insides of drawers are aged to match by soaking them in water. A lucky thing for us happened to a shipment of antiques that we imported from France not long ago. The drawers had been peppered with fine imitation wormholes, so that the wood looked like cork. The ship struck a heavy storm, and the salt water got into the hold and soaked the furniture. That was all that was needed to give it a finishing touch. We got fancy prices for that shipment.

THE drawers in furniture that is supposed to be entirely of one kind of expensive hardwood are a real problem. With prices what they are today, no dealer can afford to make antiques in that way. He has to use a combination of better and cheaper grades. And this shows in the drawers. But we get around the difficulty by lining all of the drawers with thin layers of new white oak.

"The linings were worn out and we had to replace them," we explain; and our word is taken. People, after all, like to have the insides of drawers fresh and clean. The wormer and more disreputable the outside, the better; but women don't like to put their linen in drawers that look stained and splintered.

After we finish the furniture, if it is winter, we put it up on the roof for further aging. One winter, with plenty of rain, snow and ice, does the work of centuries. Sometimes the furniture is entirely under snow for months. But we don't depend entirely on the weather to do our work. After the furniture is brought down from the roof, it is

covered with an acid that turns the wood a lemon-yellow-green.

The acid is left on for a week and brings out the grain of the wood in a very light color. With this light base, the painter can get many color effects, to suggest age.

When the desired color is obtained, the finer touches such as stains or burns are put on. We make rugs supposedly left by glassies on tables where dukes or lords or royalty are declared to have sat. Hot plate marks and burns are also added before the piece is covered with a glaze that takes away all the line divisions in the paint work.

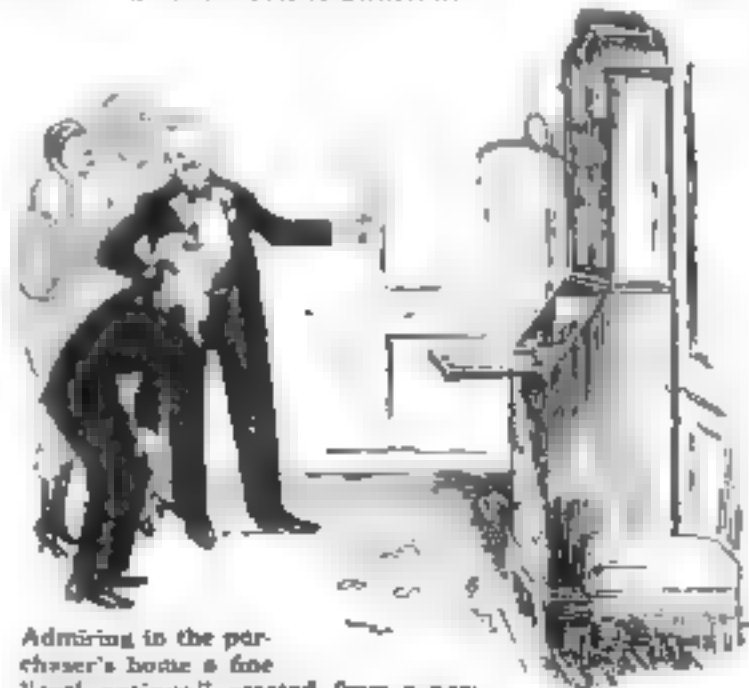
The hardware and the upholstery of our "antiques" come in for a great deal of attention. We get special hardware suited to each piece. For some furniture, we have to use special kinds of nails, but if the piece is very old we don't use nails at all. In fact, most antique furniture is put together with wooden pegs, and one of the first things we do when we get our stock from the factory is to take out the nails and put pegs in their places.

AS FOR the fabrics used in upholstery—antiques—that's a whole story in itself. A salesman told me not long ago how worn-out velvet is made. One way is to weave the material with drop stitches so that there are holes in it. Another is to put good new velvet through a machine the teeth of which pull off the nap unevenly. In either case the threads aren't cut, so the holes won't get bigger. For moth holes, drops of acid are employed. A faded look is given to the new fabric by very strong dye.

When the wood, the hardware and the upholstery are aged and worn, the piece is a "real antique." But before sending it out into the showroom it is dusted. By that, I don't mean that the dust is wiped off, it is put on. We use rotten stone, a gray pumice stone.

Some dealers even "dust" the "reproductions" of "antiques" that they themselves are passing off for real. We sell "reproductions" to those who won't pay the prices of our "real antiques." They don't know, of course, that there isn't any difference.

And these fake antiques, are they bought only by the inexperienced? Strange though it may seem, collectors are almost as often deceived by these sham antiques as the veriest amateur.



Admiring in the purchaser's home a fine "real antique" created from a new piece by a skilful faker of antiques.

Your Next Home May Be Steel

Anyone Who Can Use Wrench, Plumb Line and Square Can Erect New Type of Small House

By JOHN E. LODGE



Looks Like Brick

The house is made of steel, but the outside is finished with brick veneer. The interior is finished with plaster and the roof is made of sheet steel.



Built in a Month

Diagram showing the steel frame of a house. The frame is made of vertical and horizontal steel beams, with a gabled roof structure. The diagram is labeled 'Built in a Month'.

All Parts Standardized

The steel frame of the house is made of standardized parts. The frame is made of vertical and horizontal steel beams, with a gabled roof structure. The diagram is labeled 'Built in a Month'.



NOT long ago John D. Cole, a farmer living near the town of Milken, Mich., decided he needed a new barn. He wanted one that would last a lifetime, one that would be fireproof, lightning-proof and weatherproof. In short, one he wouldn't have to worry about for the rest of his life.

Near the farm was a steel bridge more than forty years old. Every time Cole passed over this bridge, he was impressed by the fact that although it had been exposed to all extremes of weather for nearly half a century, it was virtually as good as the day it was built.

He determined his new barn should be of steel. So he went to a Chicago bridge construction company and told them his wants. At first they thought he was joking, but finally convinced of his sincerity, they drew plans for his barn, fabricated the steel, and delivered it to the farm. With five other men, Cole set to work bolting the pieces together and riveting walls of sheet steel to the framework. In a little more than a month, in midwinter, the steel barn was completed. At once it became famous throughout the countryside. Now, almost daily,

visitors arrive at Cole's farm to inspect and admire his unique new barn.

What this farmer did is just a single striking example of a remarkable new development in the construction of small buildings, a development which some architects and contractors predict may revolutionize the building industry by solving the problem of erecting attractive small homes economically.

TODAY in England modest homes of all of steel are meeting the needs of working men of small means. These homes, of very plain design, have fabricated steel frames with fireproof walls and roofs of sheet steel. Others are of cast-iron. In the United States, sheet metal garages have been more or less common for some time. And now, in recent months, steel barns and steel bungalows have been making their appearance in increasing numbers.

In Tarrytown, N. Y., for example,

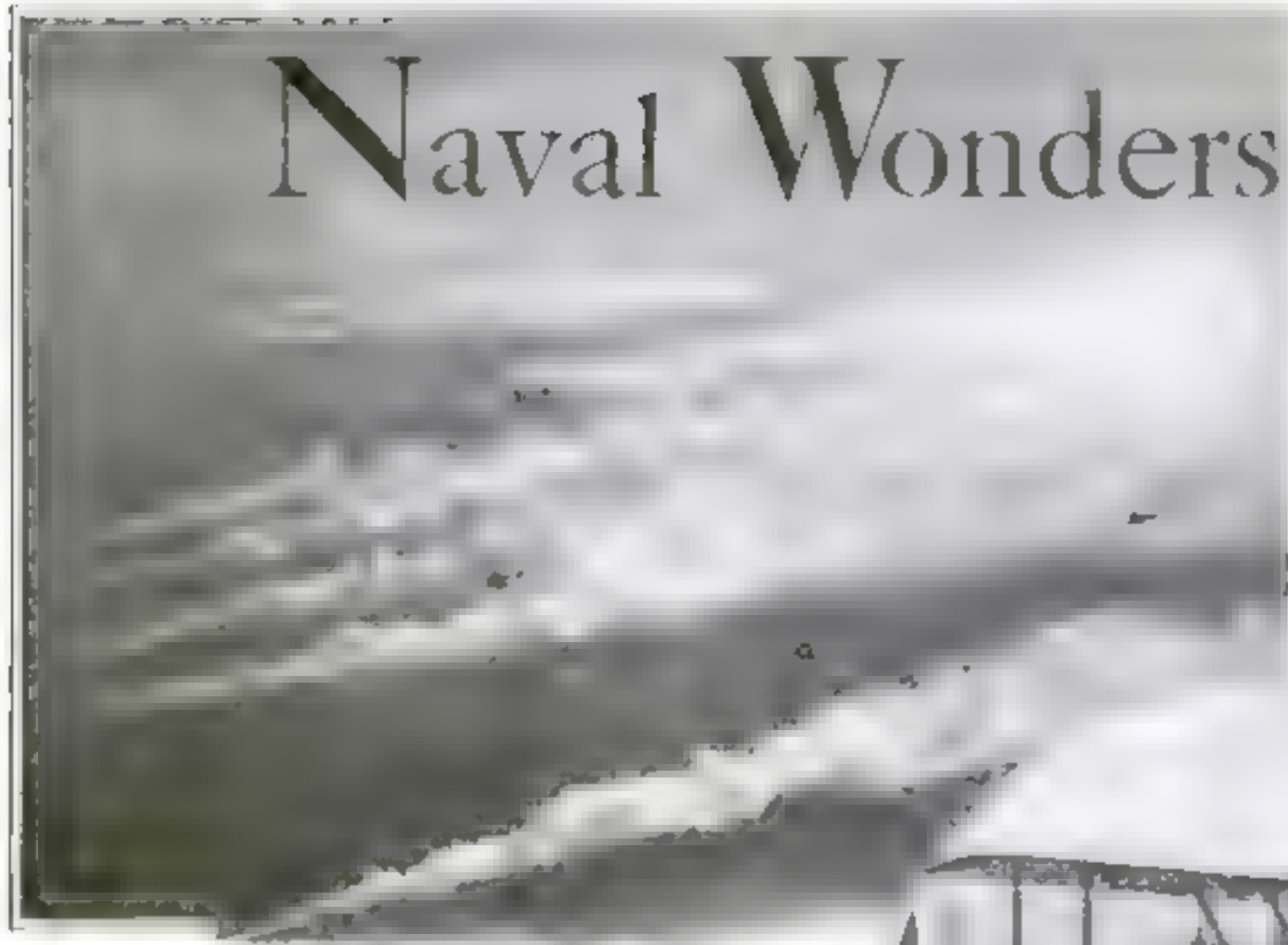
there has just been completed a novel dwelling in which the entire framework is formed of "metal timber" riveted in the shop, transported to the site, and there bolted together. Bolt holes in each unit of the frame were punched to register perfectly with the punching in adjoining units, much as the steel for a skyscraper is fabricated.

As a result, the builders declare that any person who knows how to use a monkey wrench, plumb line and carpenter's square can easily erect the frame for the house by following the plans. In this particular house the outer walls are of brick veneer, separated from them by an air space and inner walls of insulating material to which the plaster is applied.

FOR a somewhat similar home in Toledo, O., the steel frame recently was erected by four mechanics in a little more than three days. The steel cut to length, was punched on the job with a small hand punch and bolted together. Steel joists, rafters, and metal laths were used throughout in place of wood.

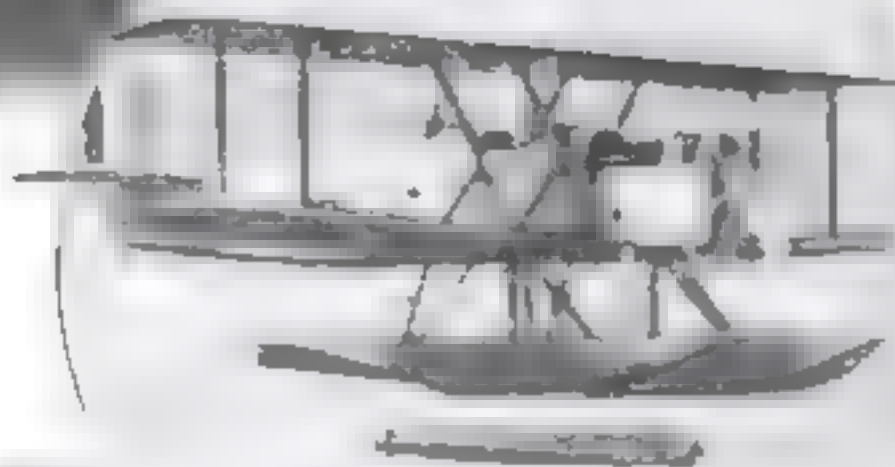
These are but two experimental examples of the new method of home building. The (Continued on page 33)

Naval Wonders *in the*



Hiding the Fleet

Destroyers (left) lay down a smoke screen, making the dreadnaughts in the rear invisible to the enemy. While airplanes above watch the movements of the foe and radio their observations to the fleet commander nearby.



Amazing New Developments In Science of Sea Fighting

CHURNING the waters of the Pacific, under the clear skies of early summer, floats a magnificent group of gigantic electrical machines, embodying the last word in the most intricate science known to man. They are the ships of Uncle Sam's Battle Fleet—America's "first line of defense" engaged in annual practice maneuvers.

Suppose, while these ships are playing at war, a foreign enemy suddenly should swoop down upon them. Can you imagine what would happen?

Of course you can't. For the ensuing combat would surpass in strange and marvelous horror the most fantastic human imaginations.

Within a single decade the decisive factor in naval warfare has passed from skill in seamanship to skill in employing highly sensitive electrical instruments and complicated chemical apparatus.

ELECTRICAL "voices" that speak incisive commands in secret language across the waves; ingenious "ears" that catch the faintest sound of an approaching enemy; smoke shrouds to conceal one foe from another; mechanical "eyes" searching beyond the concealing curtain to direct the aim of gunners at invisible targets—these are but a few of the wonderful devices designed to turn the tide of battle.

And so naval superiority hinges on the ability of inventors to find ways of protecting a highly organized electrical system from interference by an enemy from a distance, and, at the same time devise



A Scientist of the Navy

Admiral Samuel S. Robinson, commander of our Pacific fleet, distinguished sea fighter and scientist, called the father of the electrically propelled ship. He was the first American naval officer to conceive of an electrical fleet.

means of penetrating and paralyzing the systems of an enemy.

It is, then, more than a coincidence that the present commander of our forces afloat should be a scientist of the first

A Flying Menace

This great seaplane swoops down through the smoke screen and discharges its torpedo when not more than twelve feet over the surface of the water.

rank—Admiral Samuel S. Robinson, who is known as "the father of the electrically propelled ship"—the first American naval officer to conceive of an electrical fleet.

Some idea of the tremendous part electricity will play in "the next war" at sea may be gained from the fact that if any one of the nine dreadnaughts in Uncle Sam's Battle Fleet should connect its electrical mains to those of a city the size of Boston, it could supply the entire populace with the normal amount of current for light and heat. And, in addition, it could run all the city's industries and transportation lines!

Imagine yourself, in some future war, aboard one of these great fighting units as a hostile fleet approaches. The staccato "dit-dah" of the radio code suddenly flashes out the signal of "enemy contact." At once the entire fleet is electrified into motion. Light cruisers, singly and in divisions, rush past dreadnaughts, some taking station to sweep up enemy destroyers, others seeming to retire. Circles of charging destroyers form as if by magic far on the flanks.

Next War

By G. K. SPENCER

Almost simultaneously the bright day begins to turn into dusk. Clouds of smoke appear on the port bow, spread to starboard bow, and soon cover the fleet. Officers and men in the tops scan the sea above this smoke screen, searching for signs of the enemy.

Now from the rear of our fleet comes a lightning race that grows into a series of fighting planes by squadrons from the decks of a craft carried and catapulted from battleships.

The terrific battle is on. Destroyers let loose their big guns at us, directed in their fire by radio signals from the flying "eyes" above. These aerial observers themselves now are engaged with enemy scout planes.

Now and again an enemy airship dips in to the smoke fog swooping down close to the fighting tops with spitting machine guns. The "tops" reply with their own machine guns, pouring lead at the busy shapes as they dash by.

By this time every man wears a gas mask, for the smoke screens are charged with poison gases.

TORPEDO planes, whose mission must be delivered from a height only twelve feet above the surface of the sea, charge close in with protective planes striking to conceal them. Our gunners do not fire directly upon them, but rocket a shell into the water along the path of the attacker. As the shell explodes, a terrific geyser upsets the plane and dashes it into the sea.

Meanwhile aerial and destroyer scouts, supported by the fast moving light cruisers, carry constant reports.

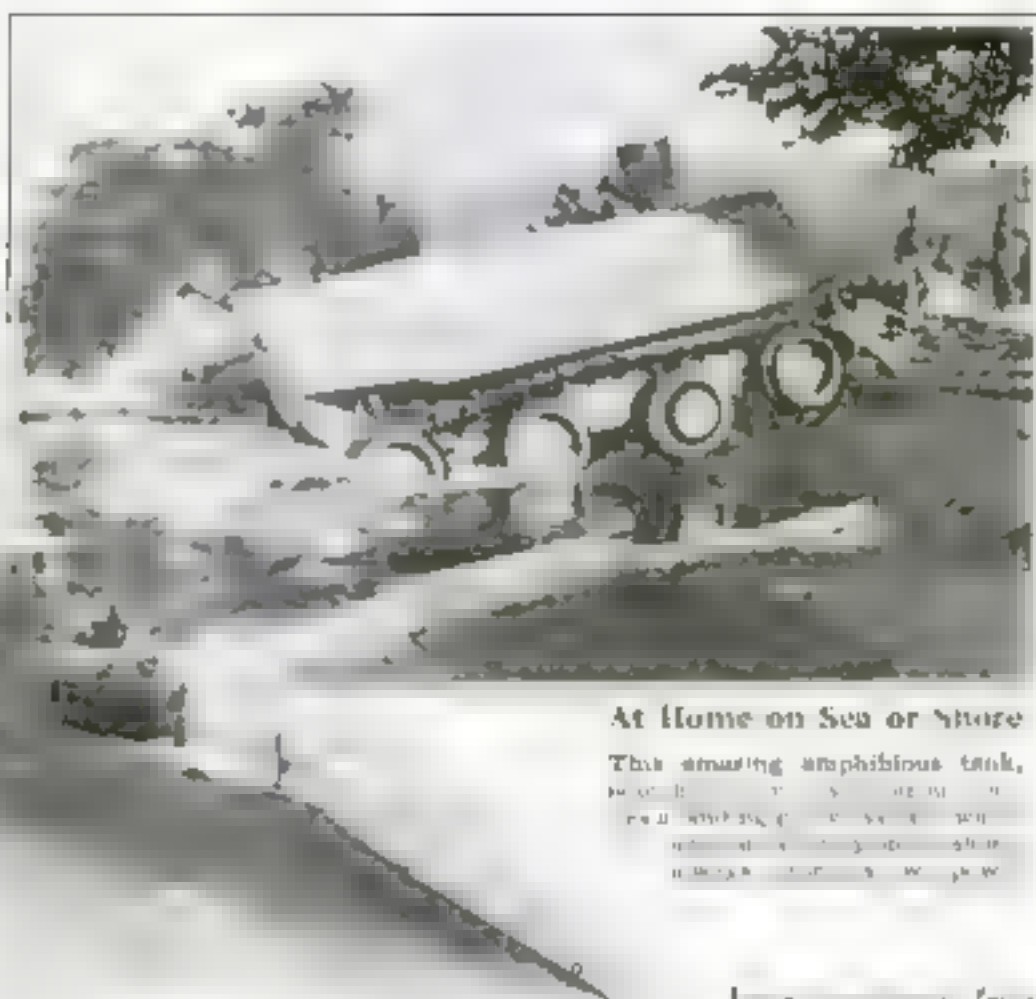
The sea goes down, but the battle continues. To the "eyes" of the fleet, night is no day. Parachute flares flood the sea with light for observers in the scout planes. The powerful searchlights of

battleships illuminate the sky above. And in this field of light lurk defensive planes, ready to engage enemy aircraft.

So, through day and night, the battle goes on, and victory rewards the fleet which keeps its "nerves" of communication unshattered while making the more ingenious use of the devices of scientific warfare.

While it is probably true that most of the new science of naval war has been brought about by the introduction of air forces, it is equally true that the success of these very forces depends almost entirely on applications of electricity.

Radio, of course, is the outstanding example. In past wars, a fleet has been able to "jam" its opponent's radio system with interference. Today the radio of Uncle Sam's forces afloat cannot be jammed. Special "selector-rejector" devices on every vessel weed out interference. Again in time of war, the radio amateur ashore will be surprised to find that where formerly he could hear the radios of the ships, now he cannot



At Home on Sea or Shore

This amazing amphibious tank, built by the U. S. Navy, can move over land or water. It is a new type of vehicle, and is being used in the war.

Let us see how they put to sea. And yet

their radio activity is increased tremendously. Communication between ships and air forces is carried on in code with extremely low-powered radio apparatus. In action, the entire fate of the warships and planes rests on the skill and accuracy of radio operators.

Of vital importance, too, is the electrical listening apparatus mounted in the hulls of all submarines, destroyers, big cruisers and battleships. With amazing accuracy, these devices not only detect the distance of another ship, but give information from which the type of the ship can be determined. They make it comparatively easy for scouting planes to pick up an enemy fleet, even at night.

ASIDE from invention in electricity, perhaps the most important problem which navy experts are tackling is that of finding a way by which air forces or ships can dispel an enemy's smoke and gas screens. The tremendous advantage of such an invention in the next war is obvious. Experiments thus far have

succeeded in settling fogs some distance in advance of ships, but the application of the method to use by air forces will also come.

Meanwhile inventors are at work devising means of protecting crews below deck against poison gas. One possible solution is the attachment of huge gas masks to the intakes of the ships' ventilating systems.

The development of an airplane motor which can be silenced, and the invention of a listening device to catch the noises of approaching aircraft, are other subjects of experiment.

These are but a few of the inventions which are being prepared for the naval engagement of the future. Certain it is that if that "next naval battle" ever comes, it will be a struggle unequalled for its wonders!



Smoke screens—great clouds hanging low on the waters—are used to hide movements of aircraft as well as ships. These seaplanes are ready to attack on signal from the scouting planes flying high above them.

Joys of a Pup's Life

What Well-Dressed Dogs Wear

A RECENTLY published story of a New York woman who spends \$4,000 a year on her pet dog disclosed an amazing number of accessories used to keep pampered pets well dressed. Spats, watches, overshoes and fur coats adorn fashionable animals. And some even have their hair dressed in the beauty parlor.



They Even Wear Spats

The Boston terrier above may not care particularly for the two-button spats his owner is putting on him, but they're the latest from Paris and he must have them. Watches, too, are decreed by dog fashions, and so the pup below, exhibited recently at a dog show, wore a nice gold one licking away on his collar.



They Go to Beauty Parlors Too

Beauty parlors for dogs are said to be doing good business. Smarty, the blue-haired terrier above, is being dried after a shampoo.



\$4,000 a Year on a Dog

Mrs. Sidney Williams of New York, who with her husband spends \$17,000 on five dogs, may be seen above. In one hand she is holding her favorite \$4,000 a year midget black and tan while in the other she has one of its expensive evening dresses. Piled about her are other bits of the tiny dog wardrobe.



He Wears Overshoes

Wet feet and a sore throat are just as bad for a dog as for its owner, so the French bulldog above is protected with special overshoes and a warm fur collar.

In the Dog's Haberdashery

Below are the latest Paris styles for his "dog ship." Note the raincoat of Russian leather on the model in the center of the fine display.



Getting a Wave

Straight hair is out of style in dogdom. The permanent wave is all the fashion. Above is a well-groomed English prize-winning pointer with his long hair in curls, and (left) a \$1,500 Pekingese getting a permanent from a dog beauty expert, whose fee must be a very tidy sum.



My Most Tempting Puzzles

Can YOU Solve Them?

By SAM LOYD

This is the second of two fascinating articles by the world's greatest puzzle expert. The solutions to the Sam Loyd puzzles presented last month appear on page 127 of this issue. Solutions to the problems on these pages will be given in our July issue.



Can You Help the Puzzled Milkman?

HONEST John, the milkman, started out the other day without his pint and quart dippers. Suddenly two customers popped out, one armed with a four-quart pail, and the other with a five-quart pail. Each demanded two quarts of milk and there was John with two full two-gallon cans, but nothing to measure with. He was about to return for his dippers when one of the women offered to show him how to fill the two orders without resorting to guesswork. Of course, it required considerable pouring back and forth between the cans and pails, but that's where the puzzle comes in. How did they solve the problem?

AN EXPLANATION of the fascination that recreational puzzles possess for so many of us is found in that dominant characteristic of the human animal—curiosity. Human nature is ever inquisitive and flares with interest when confronted by a mystery.

A puzzle is a direct if joyful challenge to this fundamental attribute of our being. "You can't discover me," jeers the puzzle from its craftily concocted concealment. "Oh, can't I, though?" is your mental response—and the chase is on.

All of us experience keen satisfaction when a perplexing puzzle has been mastered, and our triumph is in proportion to the difficulties surmounted. Once lured into trying a puzzle, we remain unsatisfied until the solution has been shown or guessed. Only a week ago I met on a New York street a man whom I had not seen for years, and before I could even inquire as to his health or express my pleasure at seeing him again, he blurted out, "Say, Loyd, remember that little puzzle you showed me? I could never quite do it. Let me have the answer, won't you?"

puzzle unsuccessfully from time to time for five years."

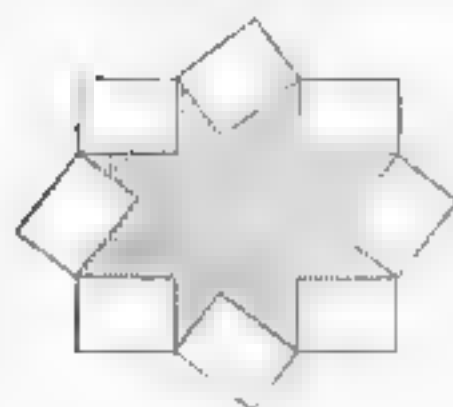
That man holds the record for perseverance as far as my own experience goes, although I must confess that I would be more ready to admit him to the ranks of confirmed puzzlers had he stuck to the problem another five years—and solved it himself.

PUZZLING is a plant of very ancient growth, and is not peculiar to any race or to any period of history.

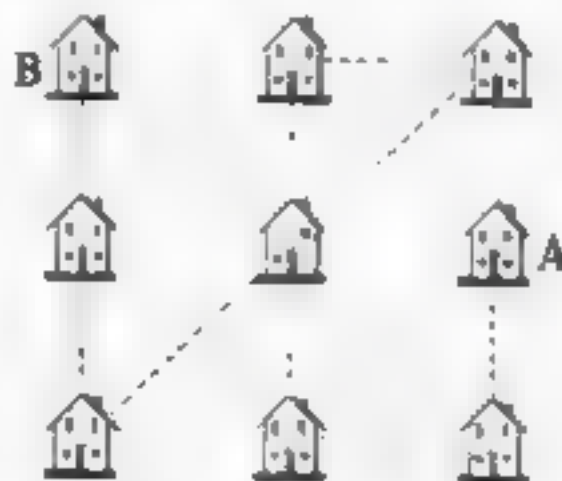
One of the oldest puzzles on record is the "Riddle of the Sphinx," which, according to mythology, was solved by Oedipus. The Sphinx used to accost passers-by with this question: "What animal walks on four legs in the morning, two at noon and three in the evening?" If the wayfarer failed to guess the answer, the Sphinx devoured him. As her own hazard in the game, the Sphinx promised to destroy herself if anyone ever guessed her pet riddle. When Oedipus submitted that the answer must be man, who walked on his hands and feet in the morning of life, strode erect in his prime at noon, and in the evening of his days supported his infirmities with a stick, the Sphinx acknowledged defeat and dashed her head against a rock.

Those of you who have been following the progress of John and Mary Newkewell in the ingenious prize contest series that has been running in *POPULAR SCIENCE MONTHLY* undoubtedly will be interested

A Florida Land Puzzle



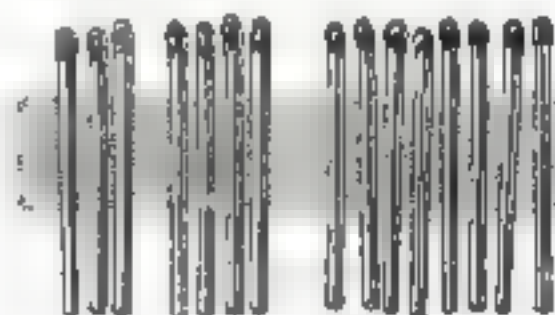
"**T**HIS business gets more puzzling every day," complained the Florida real estate agent. "Take, for example, these eight building plots, which are so laid out that each owner will have his own individual fence around his property. Now the plots are of uniform size, the width of each being three quarters of its length. I sold the plots for \$1,100 apiece with the understanding that the eight owners should pay me for the inner shaded section at the same rate a square foot that I received for the plots. What I must figure out is the amount of my bill for that little park in the center of the plot pictured. Perhaps you can help me?"



The Poultryman's Route

IN THIS little community of nine cottages, the man who dwells in the house marked A keeps chickens and supplies eggs to each of his eight neighbors. The lines on the map show his daily route, the final customer occupying cottage B. Thus, six straight strolls carry the poultryman over his route. Now it is possible for him to cover his route starting from A, visiting all houses and making B his last stop in less than six straight moves. How many less? What is your best suggestion?

Matching Wits with Matches



ARRANGE fifteen matches, pins or toothpicks in three clusters of three, four and eight as above. Then challenge a friend to a little game, the object of which is to see who will be compelled to take the last match. You play by turns, each of you taking away as many matches as you wish from any one pile at each move, continuing until one of you takes the last match—and loses. For example, you take three from the first pile, your opponent takes four from the last pile, you take three, your opponent takes four—and you lose. The player who has the first move should always win, but how should he make the first play in the game to do so?

in knowing that the first prize puzzle contest of record was conducted by Samson, mighty man of the Bible. Thirty sheets and thirty changes of garments were offered for the correct solution of his riddle, which was: "Out of the eater came forth meat, and out of the strong came forth sweetness." The answer was: "A honeycomb in the body of a dead lion."

There is another ancient riddle ascribed to Ctenobius, one of the seven wise men of Greece, which is said to have been composed about 700 B.C. It was:

"There is a father with twice six sons; these sons have thirty daughters apiece, part-cultured, having one cheek white and the other black, who never see each other's faces nor live above twenty-four hours."

THE answer was, of course, "the year." In this naive lack of subtlety, these ancient problems give evidence that puzzling, like every other form of human endeavor, has advanced with the march of time.

Then we have as a forerunner of the modern mechanical puzzle the famous Gordian knot. When Gordius, a farmer, became king of Phrygia, he tied up his implements of agriculture in such a complicated fashion that nobody could untangle them. The oracles proclaimed that whoever succeeded in untying the knot should become emperor of all Asia. Alexander the Great, after many ineffectual attempts, at last became so enraged because he was proving himself such a poor sort of puzzler that he drew his sword and cut the knot.

The peoples of the East are proverbially noted for their skill in puzzles and mystery. The puzzle game of tangrams has been virtually a national pastime in China for a few thousand years. This consists of seven flat pieces of wood cut from a square upon the geometrical angles of forty-five and ninety degrees, the pieces permitting of the construction of an endless variety of odd figures.

We may construct our puzzles with



How Did Grandma Cut the Pie?

GRANDMA had invited company for Sunday dinner, so she had baked an exceptionally large apple pie. But when her son John unexpectedly arrived with his family, and her daughter Alice with hers, Grandma's guests were far too many to be supplied even by as large a pie divided in the ordinary way. So Grandma had to devise a new

way of cutting a pie that was very ingenious because, although it required only six straight cuts of a knife, it gave large pieces for the grown folks and small ones for the children. Moreover, although she didn't realize it, Grandma cut her pie into the largest number of pieces possible with six straight cuts. How many pieces were there?

more ingenuity than did the ancients, but apparently puzzles were taken a great deal more seriously in older times, for Plutarch tells us that Homer died of chagrin over his failure to guess a riddle.

And whether some of these stories of ancient puzzling be historical fact or legend, there is comfort for the modern brotherhood of puzzlers in knowing that their favorite pastime engaged the serious attention of the famous men of old.

I HAVE learned a great deal about puzzles and puzzle addicts in the half century or so that I have been a professional constructor of puzzles. One fact that has been brought home to me in the many hundreds of puzzle contests I have conducted is that in the ranks of puzzle-dom the female of the species outnumbered the male probably two to one. The reason may be that women have more time for recreation. Then again it may be due to their possession of curiosity to a greater degree. It is another interesting fact that in the smaller communities, where the sterner realities of life are less pressing, a higher percentage of puzzle solvers exists than in the crowded centers.

One group of the army of people who make puzzling a part of life's scheme—the invalids, the convalescents, and the other shut-ins—form a battalion in themselves. It makes the puzzle man feel that he has done something more important than provide mere entertainment, when he encounters in his mail the many letters that come from the afflicted. They are the ones who fully appreciate the solace and balm that puzzle solving offers.

THE extent of a puzzle maker's correspondence is astonishing. In a series of contests I conducted not long ago for a magazine, I received an average of 50,000 letters a month. In a boys' and girls' contest I conducted for a chain of stores in one of the large cities of the East last year, more than 40,000 came to the shops with their answers. These are flood-tide marks, but the multitude of

people with whom I have been in correspondence would form an army larger than that mustered by any nation in the World War.

SOMETIMES intensely humorous developments come under the notice of the "puzzle man." One source has been, and is, puzzle hoaxes—puzzles that look easy, possess the lure that coaxes people to try them, but which cannot be solved. Such a puzzle is the "Five Brick Puzzle" shown on this page. This crops up every few years. An unsuspecting newspaper editor, intrigued by it himself, offers it to his readers. Then, when the time comes to respond to insistent demands for the solution, the editor discovers that there isn't a man on his staff who can solve it. He stalls for a few days, hoping against hope that some bright mind in the editorial family will come to the rescue. Then he calls for help.

This letter, from the editor of a Cleveland paper, is typical of dozens I have received in the last twenty years about this unsolvable puzzle.

Dear Mr. Loyd:

Herewith I enclose a puzzle which since its publication in *The* has greatly excited thousands in this town who have failed to solve it. Will you please tell me if the puzzle can be solved, and if so what the solution is?

In this case the situation was worse than the editor had confessed, for the newspaper had offered a large prize for the solution, and people were storming the office in droves. Fortunately, I was able to work out a solution to this unsolvable puzzle by employing a tricky method of paper folding. This satisfied the stampeding puzzle fans, and the riot subsided.

A GAIN, a Montreal newspaper published my "Pie Puzzle," which is reproduced above, but when the time came to give the solution printed an explanation but no diagram. The result was that the office was besieged by indignant housewives, who complained that they had spoiled many pies attempting to cut them according to directions. Why it did not occur to (Continued on page 126)

This One Can't Be Done



HERE'S a puzzle that looks easy, and seems to be easy when you try it, but yet has no fair solution. It is known as the "Five Brick Puzzle." The idea is to copy the design by drawing three separate continuous lines that do not cross one another at any point. Why is this puzzle impossible of solution? How did Sam Loyd invent a "solution" to this puzzle by tricky paper folding?

What Is Maggie's Age?

"HOW fast those children grow!" remarked Grandpa. "Tommy is now twice as old as Maggie was when Tommy was six years older than Maggie is now, and when Maggie is six years older than Tommy is now their combined ages will equal their mother's age then, although she is now but forty-six." How old is Maggie?

A Masterpiece of Tinycraft

The Wonderful Fairy Palace an Irish Knight Built



The Creator of a Real Fairy Palace

Sir Neville Wilkinson, an Irish knight, has built a miniature fairy palace in his workshop in London. The palace is made of tin and is a masterpiece of tinycraft.

By CLAIR PRICE

IN A lush wood near Dublin Ireland a bounding lady met such a she-woman as she whisk down the trunk of an ancient tree. The peer came to a great room, where a hundred father who sat at his end near by, that she had seen one of the fairies. Her father groaned exclaimed and the fairies palace was nestled beneath the roots of the old tree. The child's eyes opened wide with excitement.

Then her father went on to tell her that, although the fairies' palace was very near, neither of them could see it—no mortal eyes ever had seen it. This saddened the child. It saddened the father, too, so much so, that he determined then and there to build a fairies' palace not only for his own little girl, but for all the children of the world.

THAT was in the summer of 1906. For twenty years, in his workshop, Sir Neville Wilkinson has spent every spare hour designing, constructing and furnishing the most wonderful miniature palace ever built. He is still at the task, collecting and adding tiny furnishings rich and exquisite in workmanship to the home of Titania, Queen of the Fairies.

Four years ago the fairy palace was formally opened in London by the Queen of England. Since then 200,000 children have seen it and have given the fairy



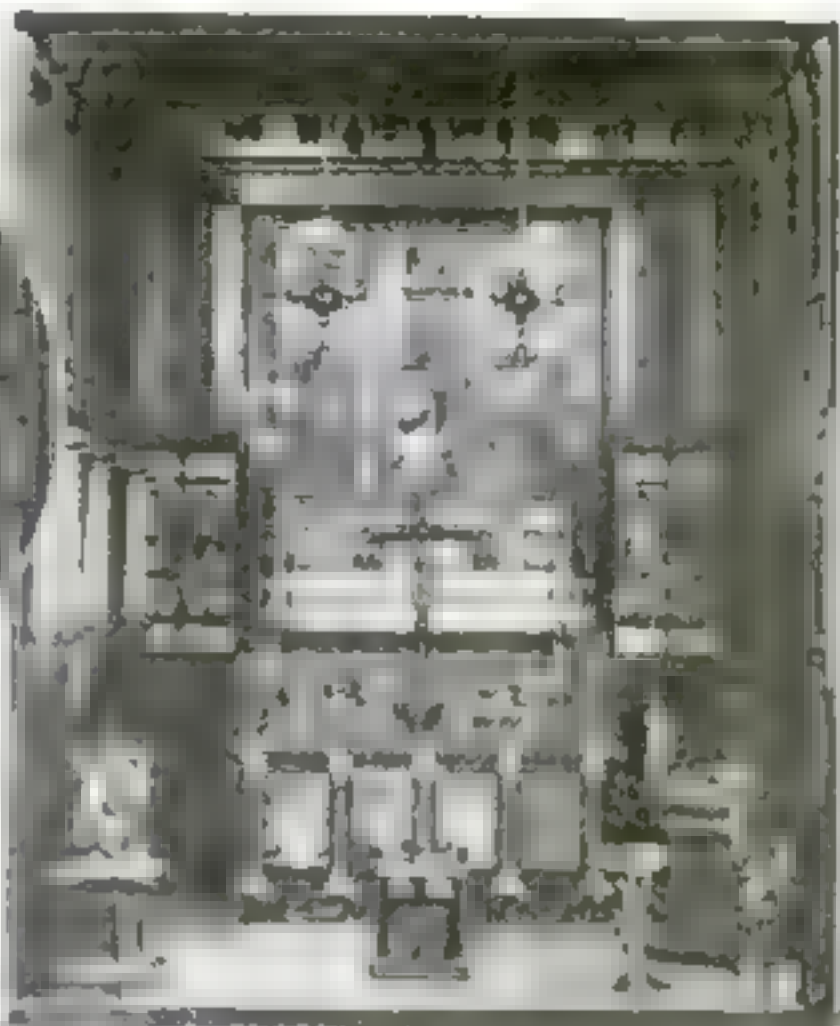
A Charming Apartment for Any Queen

This is the Fairy Queen's bedroom in "Titania's Palace." The marvelous ruffled bed, ten inches high, has five golden pillars and with ivory. On its canopy are embroidered the fairy rulers' symbols. The mantel, wardrobe, chairs and dresser are all replicas of period furniture. The complete palace occupies just the space of a billiard table.

queen their pennies, amounting to more than \$20,000, to aid crippled and unfortunate children.

And now, probably this month, the remarkable piece of tinycraft comes to the United States on its first round-the-world tour. Stopping at the Philadelphia Sesqui-centennial exposition, it will go later to New York, Boston, Denver, Los Angeles, Wellington, Sydney, Melbourne, and back to London by way of Paris. As this is written, the palace is being packed into heavily padded cases for its journey to Philadelphia. Sir Neville has built it in eight sections so that it can be taken apart. The shipment weighs almost four tons.

Imagine a complete palace occupying the space of a billiard table, with a central courtyard in which tiny electric bulbs



An Artistic Gem

Above: The chapel of "Titania's Palace." The chapel is a masterpiece of tinycraft, with its own altar, pews, and stained glass windows. The entire palace is a work of art, built by Sir Neville Wilkinson.

scattered of light in the courtyard. The palace is a masterpiece of tinycraft, with its own altar, pews, and stained glass windows. The entire palace is a work of art, built by Sir Neville Wilkinson.

Its total height is only twenty-seven inches. Its architecture is fantastic, but its materials are all real. There is no imitation work anywhere.

If for just a moment you can imagine yourself no bigger than your own thumb, you may enter its lofty hall and cross the checkered marble pavement. Just inside the main entrance you will see a cannon about half as long as your little finger, and a row of polished spears and a miniature Armada chest against a marble wall.

ENTERING the throne room, you find that the pearl and peacock throne is not yet in place. The mother-of-pearl dais, however, the rainbow-colored carpet and the ornate silver grilles about the doorway into the hall of the Fairy Kiss are there.

The hall of the Fairy Kiss is perhaps the most remarkable room in the palace. A dancing lawn from Florence stands poised beneath (Continued on page 102)

What an Architect Does for You

Why It Pays to Have Your Home Patterned to Measure—How to Read Building Plans

By JOHN R. McMAHON



"If I can keep thinking that a plan is like a road map, as you say, perhaps I can understand," observed Grace, as the architect began to explain how to read a blueprint and use a scale rule.

HAL and Grace felt quite awed as Ernest Milton, elderly and distinguished architect, led them into the sanctum of his inner office.

"I guess we ought not to take up your time, Mr. Milton," began the young man apologetically. "You do a lot of big work and Grace and I are just figuring on a little house—how to get the plans for it, and—"

"You're welcome to my time, my boy," broke in the architect with a smile. "Don't I know your folks from away back? Any useful information I may have is yours. Now about the question, boy of you."

"Please tell us first what an architect is for," suggested Grace, who had recovered composure under the host's generosity.

"Well," said Milton thoughtfully. "Let's say an architect is like a tailor who makes a suit to measure. He fits his client exactly. The stock house plan and the ready-made suit are on a par. They are likely to be loose here and tight there, rarely a perfect fit. Of course, you can make a suit with or without success."

"But, the architect's plan has the virtue of being original and unique, not a duplicate. Copies are generally inferior in some way. Also, the architect supervises the construction of the house—which is very important, since few owners have time or knowledge to check up on building details."

"What does a good architect charge?" asked Hal.

"HIS fee is five to ten percent of the cost of the house. He may save the owner that fee by his knowledge of materials and by getting a low bid from a reliable contractor. He knows the markets and ways of economy. He does plenty to earn his fee."

"First he turns out a number of preliminary sketches until the client is satis-

fied. Then he makes the finished plans, sees to the awarding of the contract, bosses the job at every stage from cellar to chimney top, and at proper intervals signs the warrants by which the mason, the carpenter and others get paid for their work. He is the owner's agent and general overseer. He orders bad work torn out and replaced by good. He sees that the specifications are lived up to, including the use of electrical wiring and the order against dumping cellar rubbish on the front lawn."

"Is an architect always honest?" was Grace's innocent inquiry.

"At least he has the professional man's reputation and code of ethics to support him," said Mr. Milton, smilingly. "He sometimes is tempted by unscrupulous salesmen of building materials, but no architect has no right to take a penny from anyone except the owner, and then

merely the fee first agreed on.

"I regret to say there are some crooks in the profession, despite the safeguards of state licensing, ethical traditions and all. Aside from downright crookedness, the public is partly responsible for lowering of architectural standards. Owners themselves demand a lot of shoddy behind for the sake of a fancy front. Like the woman who asked me to take \$100 of needed value from a house and put it into a line of shrubbery. Today there is a vogue for cellarless houses, and the architect who does not cater to it, regardless of his judgment, may be hard put."

"Would you advise us to have an architect at all, Mr. Milton?" asked the future mistress of the home.

"Young woman, you tempt me to trespass on my profession. Let's see. A six room house will do you? I thought so. In that case, you may be able to build a satisfactory house from stock plans if you are careful to pick a very reliable builder."

"Be quite certain that your plans are right, though, before you start to build, for cheap stock plans are often terrible misfits. I tried to revise a set once, and I couldn't make the parts jibe at all. It seemed a mystery, until I found that the second story was three feet wider than the first. I know a carpenter who built the lower half of a house from stock plans without looking at the blueprints for the upper half. He discovered there was no room above for his staircase. It is a good thing to make sure that your drawings will work out."

"Where can we get good ready-made plans?" asked Hal.

"TRY the local lumberyard for a starter. They'll show you something and tell you where to get more. Some of the national lumber associations issue plans, and so do the national brick manufacturers and the portland cement people, each outfit naturally exploiting its own line of material. Of course, it is better to have designs specially adapted for wood, brick, hollow tile or concrete, as the case may be. You can further look into the plans of the various architectural bureaux, which offer a sort of professional coöperative service in ready-made designs, and may even supply you with building supervision through an affiliated local architect. All these people issue books showing house sketches with floor plans, from which you can order your blueprints with specifications. It is a valuable feature, not always provided, to have a full and accurate bill of mate-

IN THIS article, the fourth of an unusually valuable series, a nationally recognized authority on home building and home ownership answers in detail one of the important problems that confront every prospective householder. Next month Mr. McMahon will tell, in the same entertaining way, the secrets of keeping your home in first class condition after you get it. Remember that Mr. McMahon is at your service, and will be glad to answer your letters addressed to him in care of POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City.

rials with the plans and specifications. This tells every stick of lumber and every brick needed for the job, which prevents waste and makes it easy to estimate cost of materials."

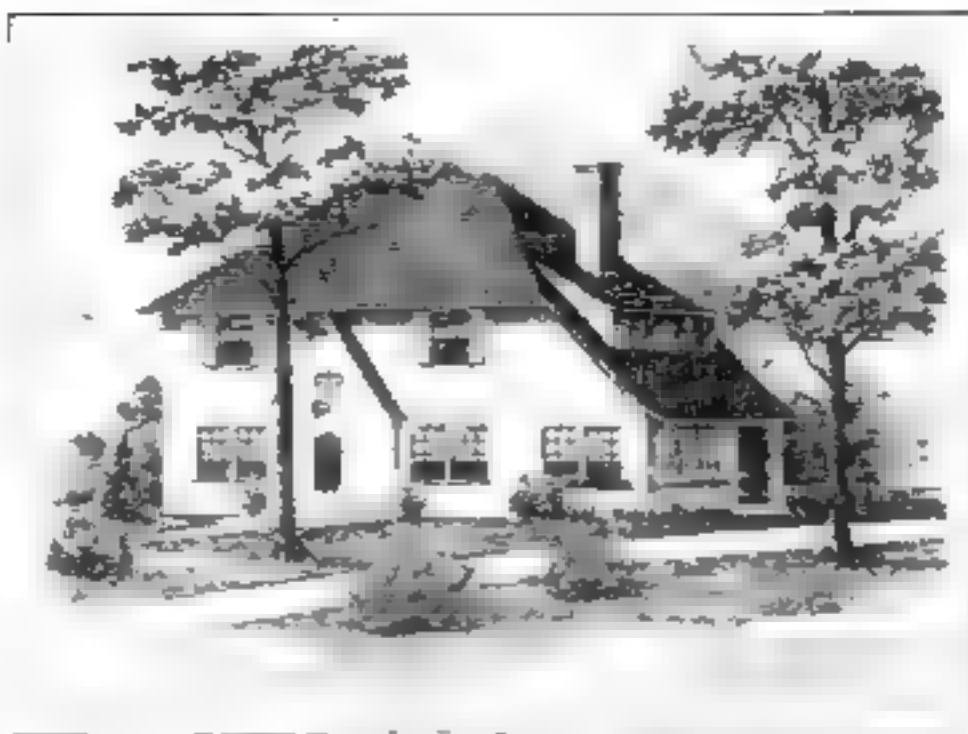
"How expensive are the ready-made plans, Mr. Milton?" was Grace's next question.

"**SOME** of the national associations practically give them away," replied the architect, playing with a triangle ruler on his desk. "Say five dollars for a set of blueprints and specifications, with an extra set at half the price. Good thing for the owner to keep a clean set while the builder musses up the other. Look, here's a circular. It says, 'Reversed blueprints only two-fifty.'"

I used to remember that designs can be reversed. In this case you're told to get the two kinds, since the regular set can be read easily for estimating and the reversed set is used for laying out the building. Certainly these are rock-bottom prices. Another concern that specializes in plans asks an average of fifteen dollars for a double set of prints, while one of the service bureaus that I mentioned wants about twice as much and doubtless gives value in its extra service."

"Guess we won't go broke buying plans when they sell like theater tickets," said Hal, grinning. "But I'd like to know how many of these blueprints a customer is supposed to get for his money."

"There should be half a dozen sheets or designs at least," replied the architect.



The architect's perspective drawing of an attractive seven-room home built in Montclair, N. J., for about \$12,000. The cost of construction, of course, would vary according to locality. The floor plans are shown below.

"That allows for two floor plans, first and second, and for the four outer sides of the house, which we call elevations—as front elevation, rear elevation and so on. If there is a cellar, that should have its design, showing the location of furnace, coal bin, stairs and such. Where the roof is complicated with hips and dormers instead of being a simple peak, it requires a separate drawing. For houses embodying elaborate or unusual features, there may be a sheet of details, giving a close-up of the front entrance, the fireplace, interior trim, or whatever special part needs explanation."

"**I WANT** to confess something," Mr. Milton announced Grace. "if you and Hal will promise not to laugh."

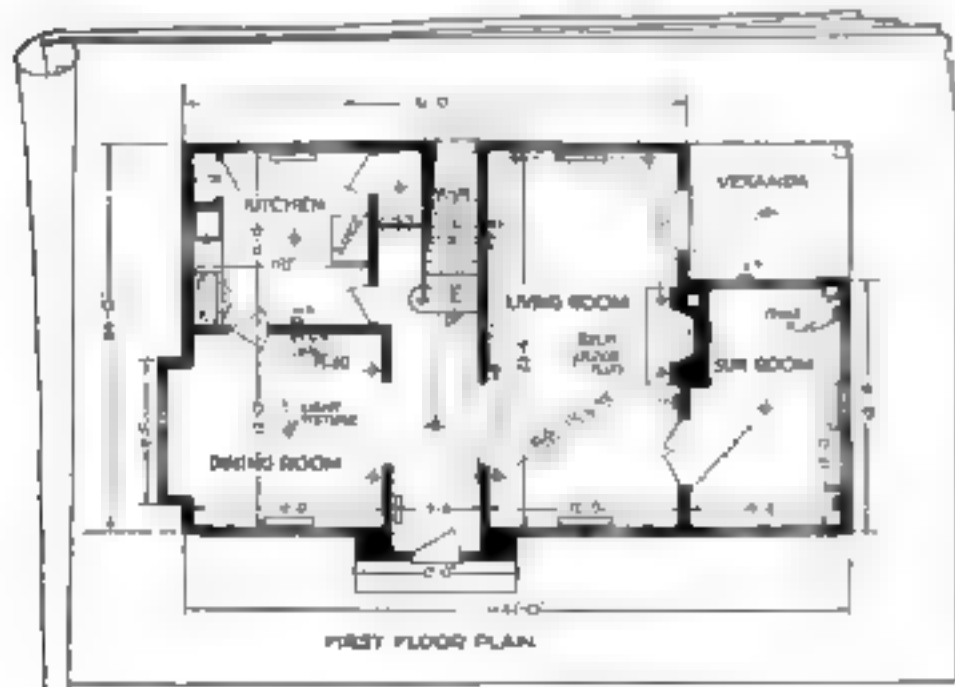
"It's a bargain with me," said the architect. "Of course I can answer for—"

"Well, we've already looked over quite a few plans. And I pretended I understood them, saying this and that was nice. But, honestly, they looked to me about like a Chinese laundry ticket."

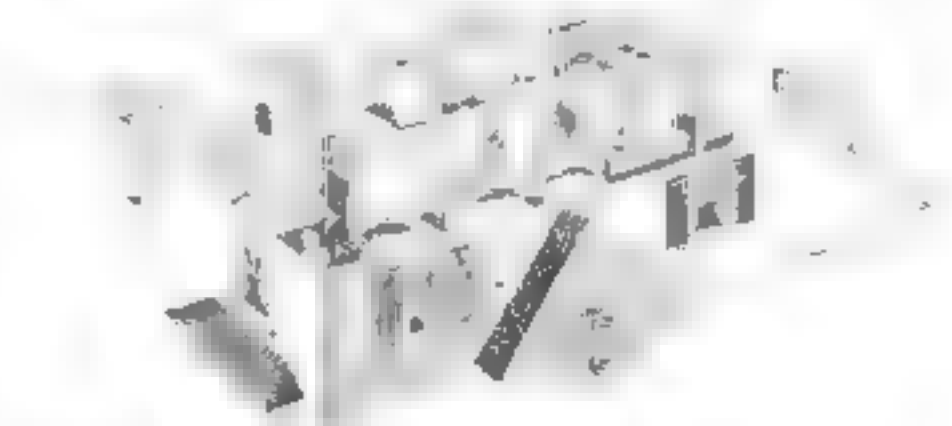
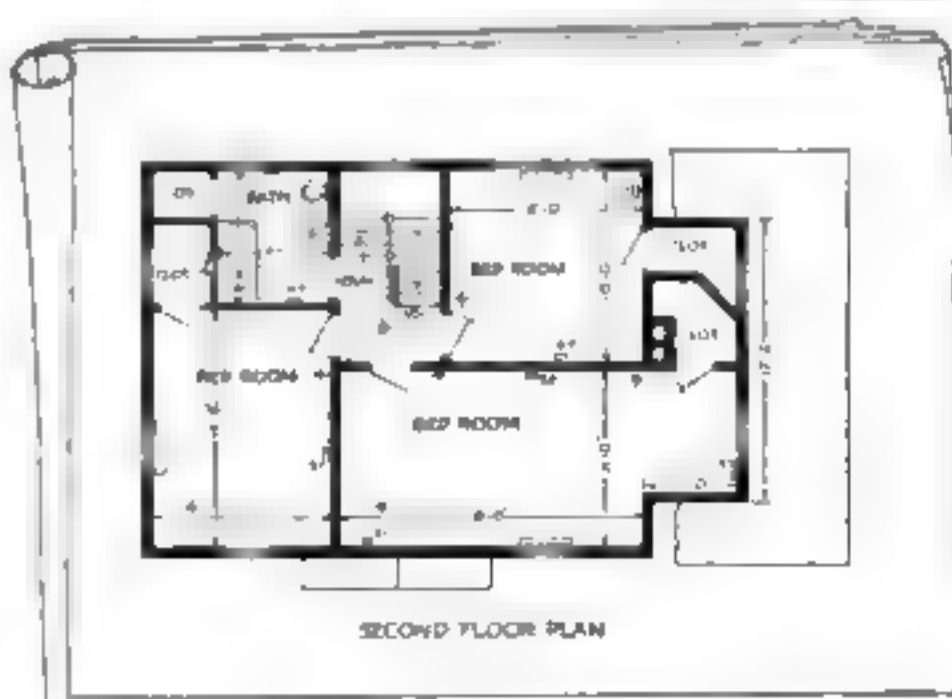
"**MY DEAR** young lady," said the older man, selecting a typical blueprint and spreading it on the desk before them, "you're no worse off than a lot of people, including some builders in country districts. Now a plan is just a drawing on the flat, that is, you see a floor as if you looked down at it from above. With a front or other outside view or elevation, you hold the plan at right angles to your eyes just as if

you stood before the building. When you're motorring, sometimes you look at the road map? That is very much like the house plan, done in the flat, with marks or symbols explained in the margin."

"Now a road map is drawn to scale, perhaps showing a mile to the inch. So is with a house plan, only the scale is larger. Suppose a house plan is marked like this—" (The architect drew: $\frac{1}{4}" = 1'$) "That means that one half inch equals one foot on the blueprint. A ruler laid on the floor drawing shows the house width is thirteen inches, or twenty-six feet. Put the ruler on the front elevation and you see that the height of the house, from grade line to eaves, is eleven inches, or twenty-two." (Continued on page 42)



Here are the first and second floor plans for the home pictured at the top of the page. The reading of plans such as these is simplified if, while you study them, you try to visualize the rooms in perspective,



as in the accompanying drawings with walls, partitions, windows, furniture and other details placed as they will be in the completed house. If you have the ability to sketch them thus, so much the better.

Keeping Abreast of Science

*American Isolates a New Element
—Other Notable Discoveries*



New English Invention to Recover Oil from Water

H. J. Melford, English inventor, demonstrating his dehydrator for separating oil from water. In the tank beside him is water freed of oil by his new process, in which goldfish may be seen swimming. His device, installed on a ship, will recover fuel oil from water pumped in for ballast.

Scientific knowledge is developing and broadening every day. New discoveries are crowding out older ideas. The man who would be well-informed of this progress must keep constantly in touch with what is happening in the world of science. On these pages *POPULAR SCIENCE MONTHLY* endeavors each month to supply in brief the information to enable him to do so.

American Finds New Element

THE home of the first discovery in the United States of an element, one of the ninety-two fundamental substances that make up everything on earth, falls to Professor B. S. Hopkins of the University of Illinois, who has named it thulium after his state.

It is one of a group of rare earths, and may exist in small quantities in gas minerals. Its discovery leaves but two elements to be discovered.

At present there are apparent no great commercial possibilities for thulium, but when the element helium was discovered it was generally believed worthless. Today it is very valuable for inflating airships. No one can tell what the future holds for thulium.

Predicts World Food Shortage

THE world is facing a food shortage. In the next century it may be acute unless new sources and more efficient methods of production and preservation are found soon. Such is the warning of Dr. Samuel C. Prescott, head of the biology department, Massachusetts Institute of Technology.

Our consumption of meat is so great that even in our time it may be necessary to seek new sources in the arctic regions or in tropical countries where agriculture is not profitable. But this

will be only temporary relief, and after another hundred years human food will consist principally of bananas, soy beans, fish and corn. We all eat too much anyway, we are told by medical authorities.

Will Get Power from the Sea

THE world's industrial power of the future may be drawn from the heat of warm sea water. Already some German scientists think they have found a way to utilize this latent energy, according to a cablegram received recently by the American Chemical Society.

The warm sea water will, they assert, evaporate carbon dioxide or ammonia, and the pressure thus obtained can be used in steam turbines to produce tremendous electric power.

The announcement is of special interest to the United States. Our great seacoast is capable of supplying power for the rest of the world.

New Source of Artificial Silk

ARTIFICIAL silk from sea shells and the claws, feelers and heads of wasps, beetles, locusts and grasshoppers! It sounds incredible. But two German

scientists, Dr. R. O. Herzog and Dr. G. Kunkel, of Berlin, claim they have made it.

Sea shells, wasps, beetles, locusts, and grasshoppers, they explain, contain a substance called chitin, which can be turned into a gelatine mass, and worked into a thin film, or forced through tiny holes to make threads. The latter are very fine in texture but strong enough to be woven into cloth.

This is only one of the many ways science is turning apparently useless waste into useful and artistic articles.

Asthma Cured by Russian

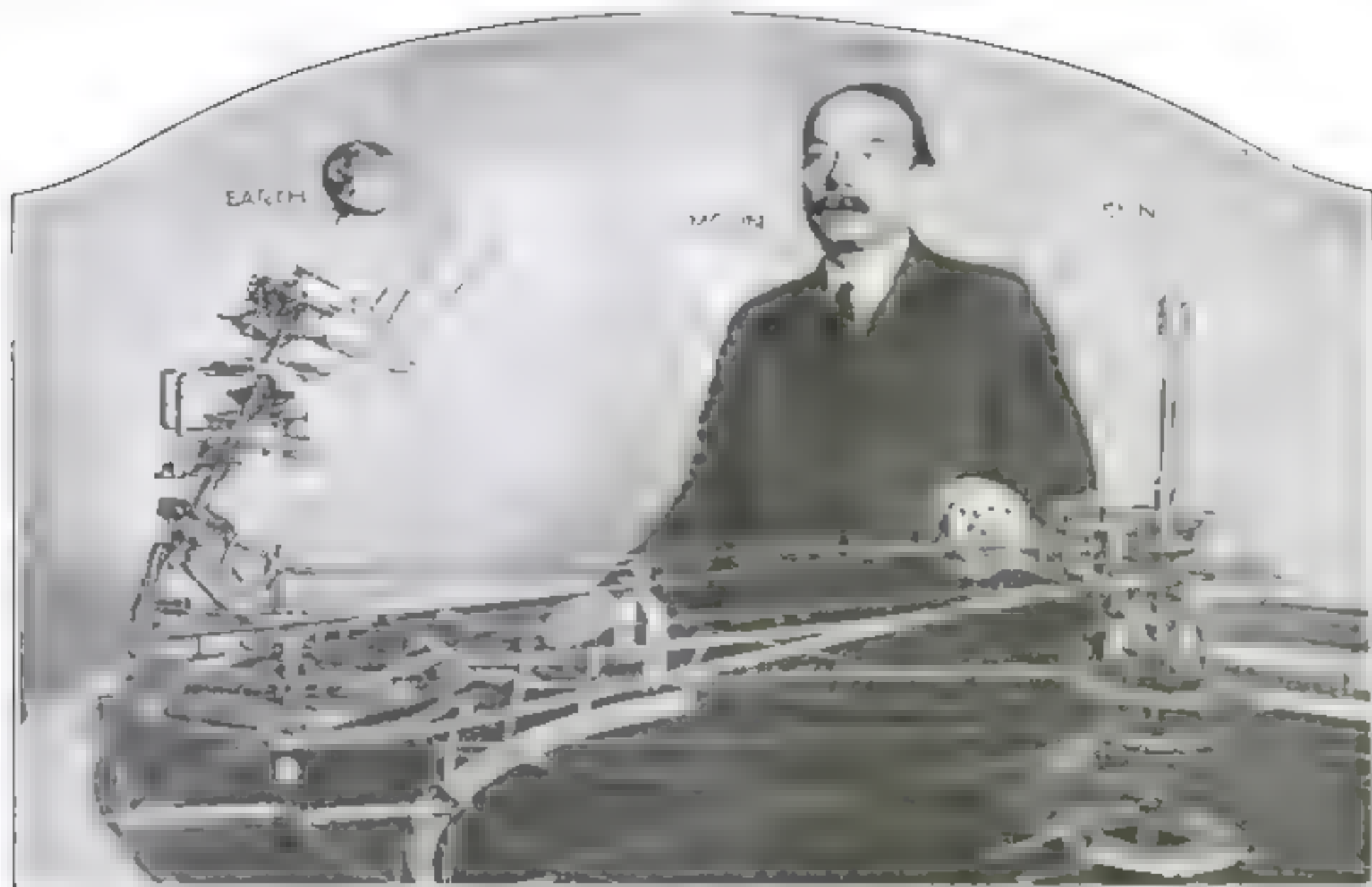
THERE is good news for asthma sufferers in reports of numerous cures by Dr. R. Cassul, of the State Institute of Roentgenology and Radiology, Leningrad, Russia. Asthma, according to Dr. Cassul, is caused by convulsions in the lobules of our breathing tubes which come in contact with the blood. These convulsions are the result of poisons in the blood reacting to irritants such as dust.

Dr. Cassul's idea is to get rid of these poisons by recruiting fighters in the blood to attack them. The spleen is the breeding ground for these fighters, and Dr.



An Iceless Cooler for Science Work

Shown above is a new apparatus for keeping liquids at an even cold for scientific purposes, being tested by F. W. Keyes of the Columbia medical school, New York City. It consists of an iceless refrigerator and a regulator devised by Harold B. Pierce of Columbia.



Miniature Solar System Reproduces Movements of Sun, Earth and Moon

This wonderful new machine shows all the movements of our solar system. It was recently constructed by Diego Azzi, a Chicago mechanical engineer, who stands beside it. It is made of steel and is mounted on a steel platform nine feet across. Regulated by a clock set to standard time, it reproduces the revolution of the earth around sun, rotation

of the earth on its axis and journey of the moon around the earth. It also indicates the change of seasons and gives the day, the month and the year. A powerful spring located in the center starts the machine. By the use of this mechanism it is possible to determine the occurrence of eclipses, their paths and various other phenomena

Gassul claims that by stimulating it with electricity he can muster enough fighters to drive out the asthma. Special high-frequency current is used, and the treatment takes from three to six months, depending upon the condition of the spleen when the treatment begins.

While further reports of cures by Dr. Gassul's method are awaited, people with sensitive breathing tubes, and, in fact, everyone should be on guard against the effects of dust, which is one of the chief evils of big cities.

Athletics Do Not Hasten Death

ATLETIC sports don't lessen a man's chances of living long any more than study does. That is what statistics of the class of 1873 of Princeton University indicate.

Of the twenty members who were on football, baseball, track, and gym teams or crews, ten are still living, each more than 70 years old. Football, the most strenuous of all sports, strangely has the best record of all—five out of nine men who played it are alive. Of the ten men who stood high in their classes, six sur-

vive. The same conclusion is reached by Dr. Burgess Gordon, of Boston, after examining Marathon runners. He failed to find the "athletic heart," the much-talked-of base of athletics. Instead, he found that the heart, instead of swelling from hard exercise, actually shrank, and that prolonged training did not result in

any enlargement. Men who strive for honors in sports need, then, it seems, have no fear of heart strain or a short life.

An Easy Way to Get Thin

A NEW way to get thin, discovered by Dr. G. Leven, of the Therapeutic Society of Paris, will interest stout people who dread the approach of summer. It involves no medicine or strenuous exercise. In fact, the treatment may be taken in bed.

All that is necessary besides following an easy non-fattening diet is to inhale very little air and to breathe out hard. The usual dose is five exhalations every half hour, fifteen to twenty times a day.

Hundreds of patients are said to have benefited by the new treatment. One is reported to have lost fifteen pounds in twenty days; another, sixty pounds in eight months. Still the man who is in earnest about losing unnecessary weight will stick to proper diet and moderate exercise for sure results.

Secret Messages Promised

THE problem of secret communication for military work in war time that has so far baffled our leading engineers, may be finally solved by two remarkable recent American inventions.

The first, developed by D. C. Stockbarger, instructor of physics at the Massachusetts Institute of Technology, consists of modulating light waves as radio engineers modulate the carrier

waves in ordinary broadcasting. With an extremely powerful searchlight, he has transmitted long distance messages that could not be intercepted by any apparatus not actually in the path of the sharply focused beam of light. The light waves he used are in the violet and ultra-violet, while previous attempts along this line had employed infra-red, sometimes called "black light."

The other invention, by Harvey C. Hayes, research physicist of the Naval Laboratory, is an apparatus for producing sound waves, which he calls "super-sounds," at the enormous frequency of 120,000 kilocycles a second—the limit for the human ear is from thirty to 30,000. These waves, it is claimed, can not be picked up except by an instrument especially tuned in and directed in their path. With Dr. Hayes' invention, secret signals can be transmitted to and from submarines even when they are submerged. It may also prove invaluable in rescue work when a submarine meets with an accident and is helpless far below the surface of the ocean.

Seeks Live Animals for Zoo

A NEW American expedition sent out by the Smithsonian Institution of Washington, D. C., with the financial aid of Walter P. Chrysler, the automobile manufacturer, has just gone to British East Africa to obtain live wild animals for the National Zoo. It will hunt for many rare species never before seen in America. It is in charge of Dr. William W. Ma-

Now the Trackwalker Rides

NOWADAYS almost everyone rides, so why not the trackwalker? This new one-man car for railroad track inspectors is the first of its kind. Although light enough so that one person can lift it on and off the track, it is strong enough to carry five men at a time. The car is driven by a motorcycle engine and can be started from a standstill. It travels at a rate of about four miles an hour, thus permitting the inspector to examine the tracks carefully as he rides.



The trackwalker's small car covers many miles in a day



Pincer Wire Tap Does the Work of a Wall Plug

HOUSEHOLDERS in France now are using the pincer connection illustrated above to tap electric current from a wire in order to get an additional outlet for household purposes. A spring in the pincer presses two sharp needle points through the insulation of the two wires when parted, tapping the current.

In the use of this device, it is claimed, there is no danger of causing an accidental short circuit. The invention can be used, also, for making a direct floor or wall-plug electrical connection.

Experimental Highway Has Non-Skid Treads

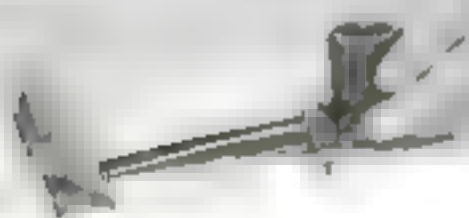
A NON-SKID automobile road to take the place of non-skid tires is the latest idea to be tried out in an English town where motor traffic is unusually heavy. There an experimental road has been paved with wood blocks which have projecting rubber insets made in designs similar to the treads on some rubber tires.

Only half the road is covered with these rubber projections, the other half being left smooth for comparative tests. The number of accidents on each side of the road is being recorded carefully, and also other data which, within a year's time, is expected to determine the value of this unique type of paving.



Odd pavement built with non-skid tread

"Poker Pipe" Attachment Keeps the Bowl Upright



TO KEEP any straight-stem pipe from tipping over as it spills ashes on table or desk, this ingenious little support has been devised to clamp over the stem. It consists of a spring loop with metal legs attached. The loop is pushed up over the stem, which it grips tightly, keeping the bowl in an upright position. The device is small enough so that it may be left in a pipe even when it is slipped in the pocket.

High and Low Powered Men

SOME people are born with more man power than others, just as some automobiles are made with more horsepower than others, according to Dr. Max Scham of the University of Minnesota. He declares you shouldn't expect a half-man-power man to do as much work as a whole-man-power individual. The nervous system of the former is not equal to the strain, and may break under it.

Hearing the Muscles Creak

MOST people think that clenching and opening the hand is entirely noiseless. But as a matter of fact, every muscular action is noisy. Every time you move or breathe or talk, you creak.

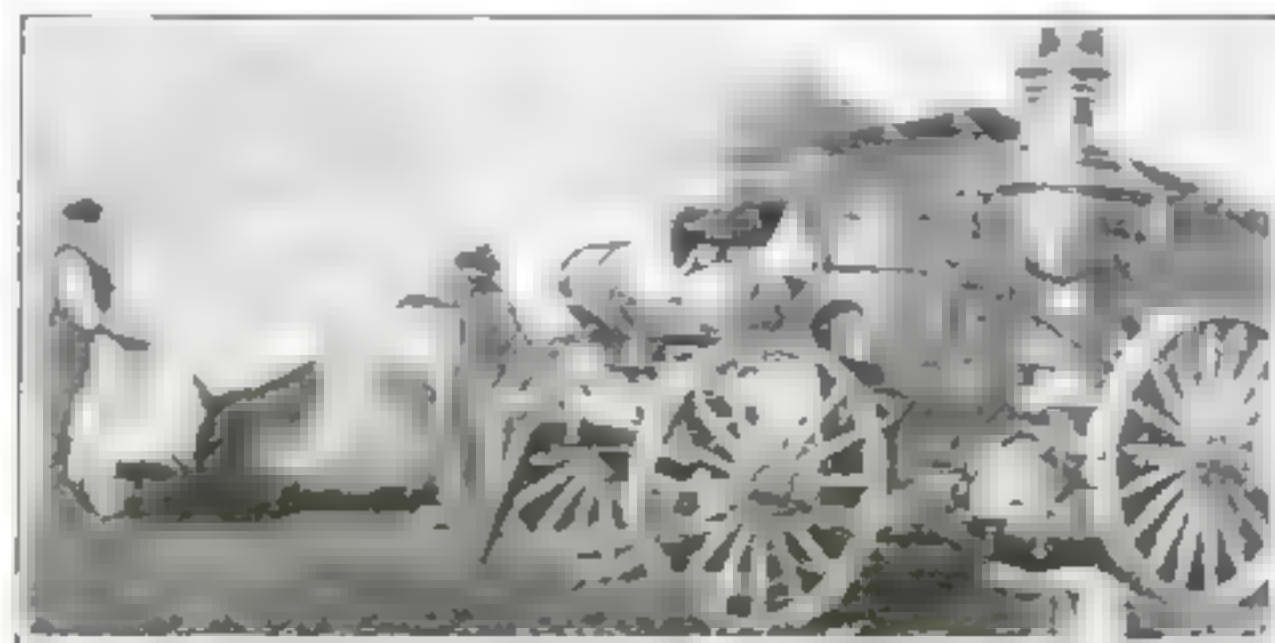
This fact was recently proved by means of a new electrical stethoscope perfected by the Bell Telephone Laboratories, in New York City. In a recent demonstration of this amazing instrument, three hundred persons heard the scratching and rumbling of the muscles as they slid over one another in clenching and opening the hand. To make the noises thus audible, it was necessary to magnify the sound one hundredth of its original force.

Old-Time Fire Engine Fights Walnut Pest

AN ANTIQUATED horse-drawn fire engine, unused for thirty years, was hauled from the discard in Santa Barbara, Calif., not long ago, to aid in fighting the codling moth, the worst enemy of walnut growers. Instead of

water, the engine sprays steam on the trays in which the walnut crop is dried.

Experts say that live steam destroys the larvae. The trays are piled high in stacks, covered with canvas, then live steam of 170 degrees is shot under the cover.



Using the antiquated fire engine to spray steam on covered trays of walnuts

Here's a New Kink for the Permanent Wave

TO TAKE guesswork out of permanent waving, a machine has been invented to test hair. Hair curls naturally because it is porous and absorbs moisture in the atmosphere. The permanent waving process alters the structure of straight hair so that it, too, will absorb moisture easily and curl. In the process, certain lotions are used. The new machine tests a sample of the hair to be waved and determines just how porous it is and consequently how strong the lotion should be.



Testing human hair with the new scale invented by C. Nottle

You Can Iron Your Neckties over the Teakettle

NECKTIES may be perfectly pressed, it is claimed, simply by running them over the edge of a new teakettle steamer invented by J. D. Horton, of New York City. With the same device, old velvets, ribbons, silks and satins can be steamed to look like new, he says.

The steamer, which can be attached over the spout of any teakettle, has a narrow slotted mouth across which the necktie is drawn so that it comes in contact with the steam from boiling water in the kettle. The rounded edges of the mouth provide a smooth ironing surface which dries the material as it is drawn back and forth.

With this device, the inventor says, any man can do his own ironing.



Steaming the blade like a straight razor

A New Idea for Stropping Safety Razor Blades

SAFETY razor blades may be sharpened on an ordinary razor strop with the aid of the blade holder shown in the picture. The blade fits in one side of the holder, and when one edge is sharp the holder is reversed so that the other edge may be sharpened. A guard prevents the blade from cutting the strop.

Sliding Fastener Now Used on Baseball Mitts

THE latest application of the quick-sliding hookless fastener, which for some time has been used on tobacco pouches and galoshes, is as a substitute for straps on the glove of the baseball player.

Not only does it save the bother of fastening a strap with one hand, but it prevents binding on the ball player's wrist. One pull on a key at the back of the glove does the trick, fastening the mitt snugly in place.



One quick pull fastens the mitt

A Springless Suspension for Motor Cars

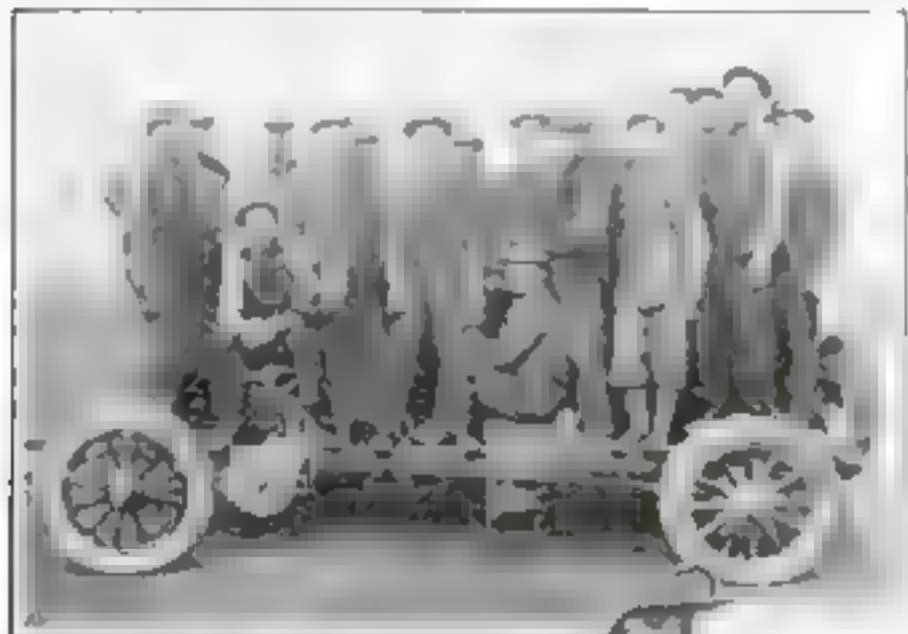
FOR a long time automobile designers have been working to improve spring suspension, trying especially to get rid of wearing parts. Walter Lawson Adams, of New Haven, Conn., now claims to have solved the problem by eliminating springs altogether and substituting disks

of rubber in a unique invention of his.

In place of springs, he has devised a strong prestressed cantilever arm attached at one end to the axle and having a drum at the other end. The inner face of this drum has teeth radiating from the center. A strong steel disk, also made

with teeth, is bolted to the axle end of the arm. A rubber disk, three times as thick as the steel disk, is placed between the two disks. The rubber disk is shaped so that when the cantilever arm is stretched, the rubber disk is compressed.

When the car has a bump, the rubber disk is squeezed between the two steel disks, which are stretched. No friction is involved.



Above: Chassis with springless suspension supporting seventeen tons. Right: Arrangement of new rubber suspension

No Rest for the Potato

FROM now on potatoes will work overtime if science has anything to do about it. Potatoes just dug from the ground have been insisting upon two months' rest before going to work and sprouting new vines. But now Dr. Frank E. Denny, of the Boyce Thompson Institute, Yonkers, N. Y., tells us that dousing them in a certain chemical bath will open their eyes wide and start the shoots at once, lessening time between crops.

The Curious



The Right Size for a Small Apartment

The man in the picture

is a small apartment

in the city

in the city of New York

A Peep into Paradise

The picture shows a

man in a suit

in the city

in the city of New York

in the city of New York



Choosing Food for the

man in the picture

Smaller Than a Coin

The picture shows a

man in a suit

in the city

in the city of New York

in the city of New York



Memories of Outer Days

A unique collection of photographs, including a man in a suit, a woman in a light-colored dress, and a group of people, is shown above. Catherine Slater was the winner.

Opera from a Tire

The picture shows a man in a suit, a woman in a light-colored dress, and a group of people, including a man in a suit and a woman in a light-colored dress.



How Ship Bottoms Are Kept Clean



Scrubbing a Liner

Below: Cleaners in small skiffs scraping a section of a ship's bottom. When the bottom is bare, a fresh coat of paint is applied. A light sand-blast is then used to remove the old paint.

Parts of Ship Seem to Suck

Requiring the big pumps to be used to get the water out of the dry dock.

IN THE water, as they dock, the hulls of San Francisco and Los Angeles liners seem to be sucking up the bottom of the harbor. Every day, as the ships are being towed into the dry dock, a great deal of water is being pumped out of the big basin. Scores of men in small skiffs surround the ship and set to work frantically with brushes to scrape off the mud, barnacles, and other foreign matter that accumulates in a few months on a ship's bottom, slowing down its speed and damaging its hull.



This amazing mass of rubbish is first scraped with wire brushes. A second brushing with ordinary brooms follows. By the time the water is pumped out of the dock, the hull is free of all debris. When the sides of the ship dry, a coat of

waterproof paint is applied, and the job is done. Many ship owners have found that the new American method of ship washing is the only efficient protection against these ravages.

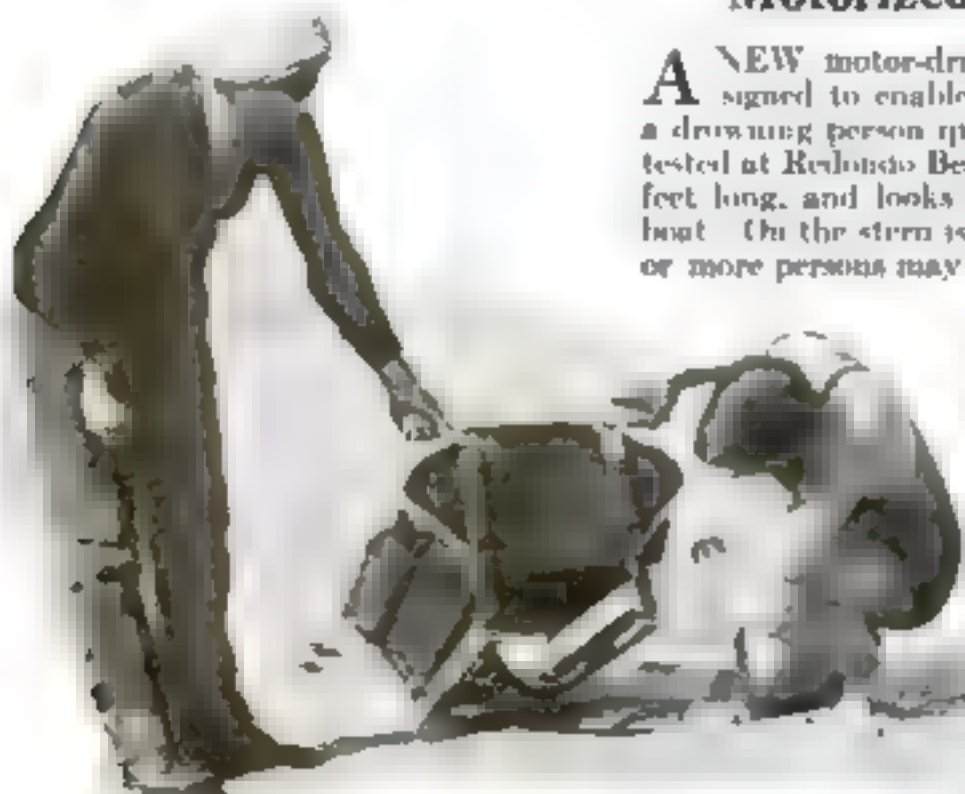
San Francisco and Los Angeles liners have found that the new American method of ship washing is the only efficient protection against these ravages.

The waters and climate of the Orient have a peculiar damaging effect on ship bottoms, causing the paint to peel off and corroding the heavy steel plates and rivets. The new American method of ship washing is said to be the only efficient protection against these ravages.

Motorized Buoy Tows the Drowning to Safety

A NEW motor-driven life buoy, designed to enable a rescuer to reach a drowning person quickly, was recently tested at Redondo Beach, Calif. It is four feet long, and looks like a small motor boat. On the stern is a bar to which one or more persons may cling. A button on

the stern bar starts and stops the motor, while the operator acts as the rudder. Its inventor, Jules E. Haschke, an electrical engineer, claims it is unsinkable and easily launched in the worst breakers, and can ride the roughest seas at better than six miles an hour.



Jules E. Haschke, inventor, left, and his motor life buoy, which is seen also in picture at right in the act of towing rescuer to swimmer in distress.



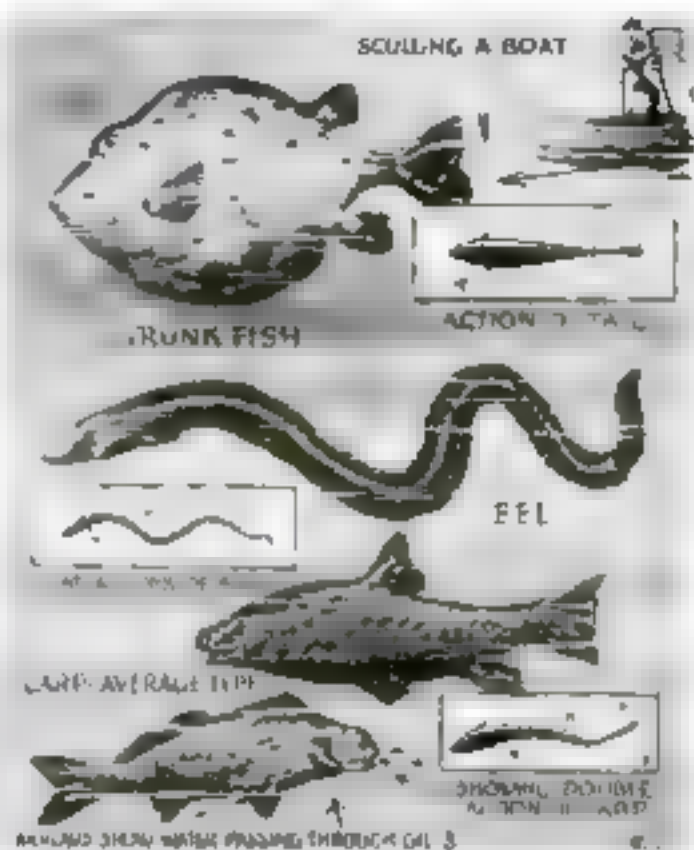
A Sea Mystery Solved

*With Strange Models,
a Young Scientist Shows
Just How Fish Swim*

The model below, designed to show how fish swim, moves in the water exactly like the rigid-bodied fish that uses a tail thrust in the act of swimming



C. M. Breder and his model that reproduces the motions of the eel type of fish—great travelers in water



The various ways fish propel themselves are shown in the drawing above. Top, by the tail movement next by the body motion third by a combination of the first two, and, below, by expelling water from gills

ONE day about three years ago a mechanical engineer strolled into the Aquarium in New York City, and, finding C. M. Breder, a research associate asked, "How do fish swim?" He was looking at a boat, he explained, and thought he might be able to apply some of the mechanics used by speedy fishes if he knew what they were.

"I was stuck," admitted Mr. Breder. "I had been studying fishes for years, but I couldn't answer his question. And I found, when I looked it up in books, that apparently no one else knew either. So I decided to find out."

Mr. Breder had plenty of material to work with for in the Aquarium are fish from all parts of the world. He started by examining their fins. He operated on some, removing one fin at a time and observed how the loss affected their movements.

AFTER numerous experiments, he built two little metal boats which duplicate the movements of fish and solved the mystery of how fish swim. For this contribution to natural science, the New York Academy of Sciences has awarded him a prize of \$2,500.

The first of these models is a flat, box-shaped boat which has a metal "tail" that is detachable, so that different shapes can be used in the experiments. Inside the boat he put a phonograph motor. Each revolution of the driving shaft gave one com-

plete movement of the tail of the "fish."

"I call this the cow, or trunk fish model," explained the inventor. "It demonstrates one of the two extreme types of swimming—a rigid body propelled by a flexible tail and paddle-like fins. The cow fish is a peculiar tropical fish, sometimes seen in Florida. Its body is encased in a shell of ossified scales, practically rigid, but its tail is flexible. Flipping this tail moves the fish, but it can go only forward. A sailor sculling a boat produces the same motion."

"The other extreme is the eel type, where the swimming is done by backwardly moving curves in the body. My

eel model boat, box shaped also, instead of a tail has a row of stiff wire rods on the bottom. On these, webbing is stretched. When the motor moves the rods back and forth, the webbing waves backward like a flag in the breeze. The backward pressure of these little waves pushes the boat forward.

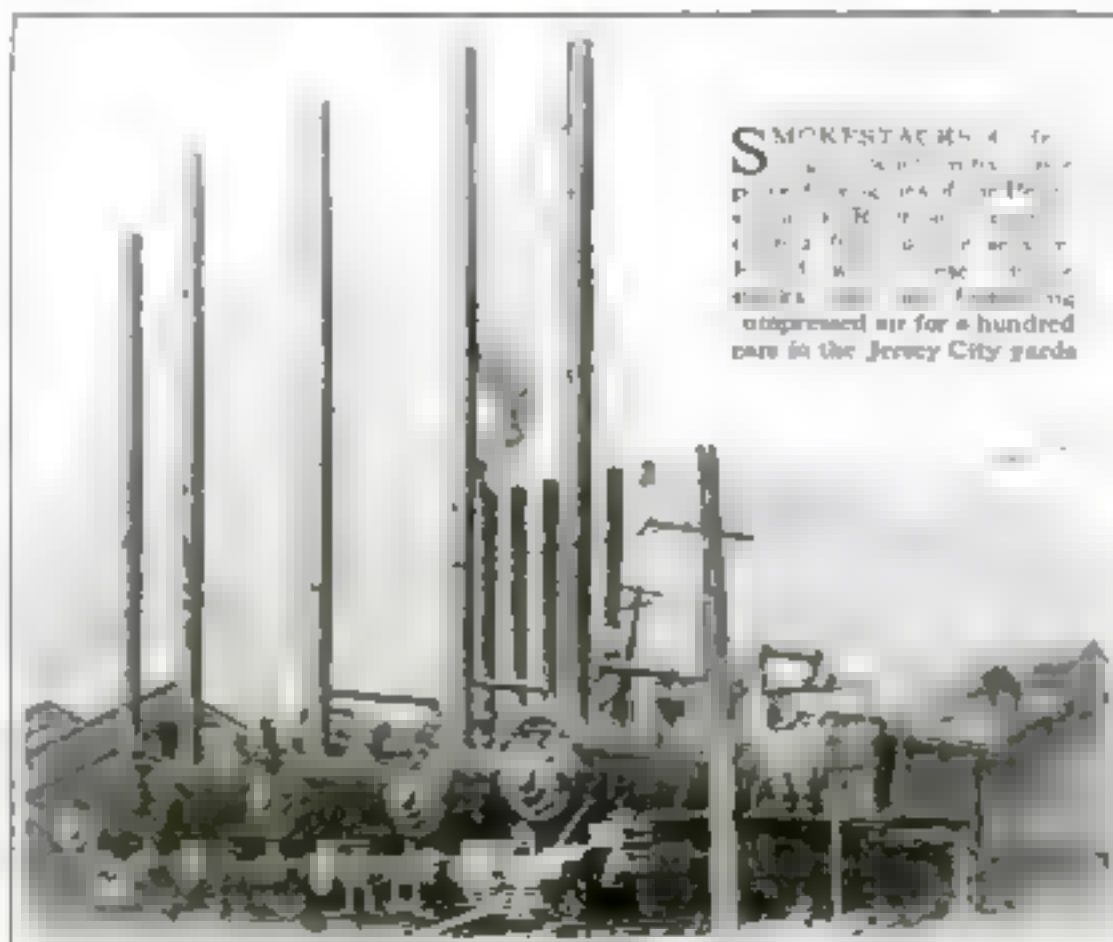
"Fishes with this body movement can swim just as well backward as forward. They get this motion by contracting and relaxing their muscles, which go around the body in bands. In swimming, the contraction of muscles begins on one side just back of the ear and passes back toward the tail, and naturally reaches the

tail quicker on the side on which it begins, making that side shorter than the other. The fish's body thus forms a curve. The next curve is in the other direction, and so the fish can propel itself through the water.

"MOST fishes combine these two motions of the tail and of the body.

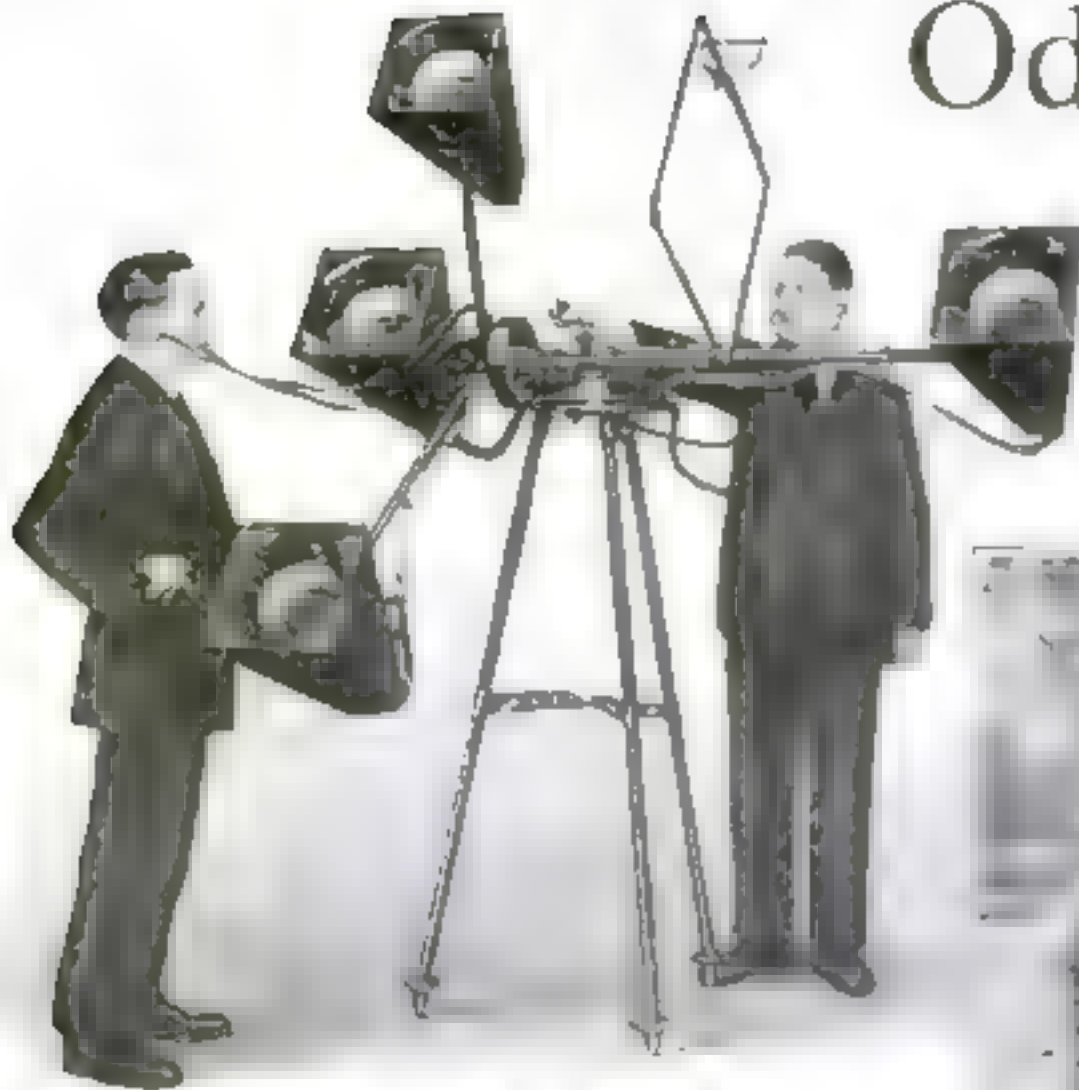
"One other thing may be important in propelling fish," Mr. Breder finished, "and that is the water they squirt out of their gill slits. These jets of water ejected from either side of the fish's head reduce the water piled up by the forward movement of the fish, and reduce the sucking effect as the fish's body is pulled away from the water behind it."

Locomotives with 45-Foot Stacks



SMOKESTACKS 45 FEET HIGH, AND 10 FEET IN DIAMETER, AT THE NEW JERSEY CITY POWER PLANT. THE PLANT IS THE LARGEST IN THE WORLD, AND PRODUCES 1,000,000 KW. OF ELECTRICITY. THE PLANT IS THE LARGEST IN THE WORLD, AND PRODUCES 1,000,000 KW. OF ELECTRICITY. THE PLANT IS THE LARGEST IN THE WORLD, AND PRODUCES 1,000,000 KW. OF ELECTRICITY.

Odd Items from



English Doctor Focuses Golden Images

The English doctor has developed a new method of focusing the golden images of the human body. The method is based on the use of a special lens which is placed in front of the patient. The lens is made of a special material which is transparent to the golden light. The patient is then placed in front of the lens and the golden light is focused on the patient's body. The result is a clear, sharp image of the patient's body, which can be used for medical purposes.

U. S. 100 - Wind & Log Bomb

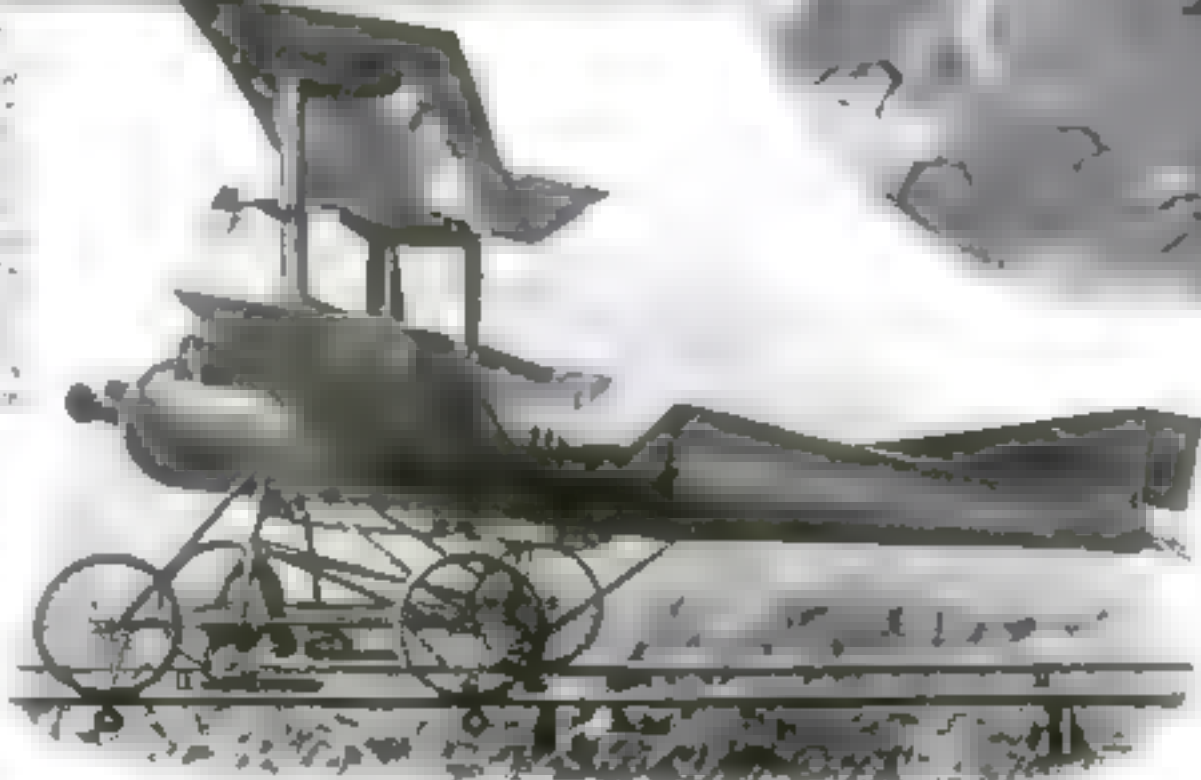


A New Type of Motor

The new type of motor is a gas engine which is designed to be used in a variety of applications. It is a compact, efficient engine which can be used in a wide range of situations. The engine is made of a special material which is resistant to wear and tear. It is also very easy to maintain and repair. The engine is designed to be used in a variety of applications, including as a power source for a variety of machines and equipment. The engine is also very quiet and efficient, making it a popular choice for many applications.

A Terror of the Air

The new type of motor is a gas engine which is designed to be used in a variety of applications. It is a compact, efficient engine which can be used in a wide range of situations. The engine is made of a special material which is resistant to wear and tear. It is also very easy to maintain and repair. The engine is designed to be used in a variety of applications, including as a power source for a variety of machines and equipment. The engine is also very quiet and efficient, making it a popular choice for many applications.



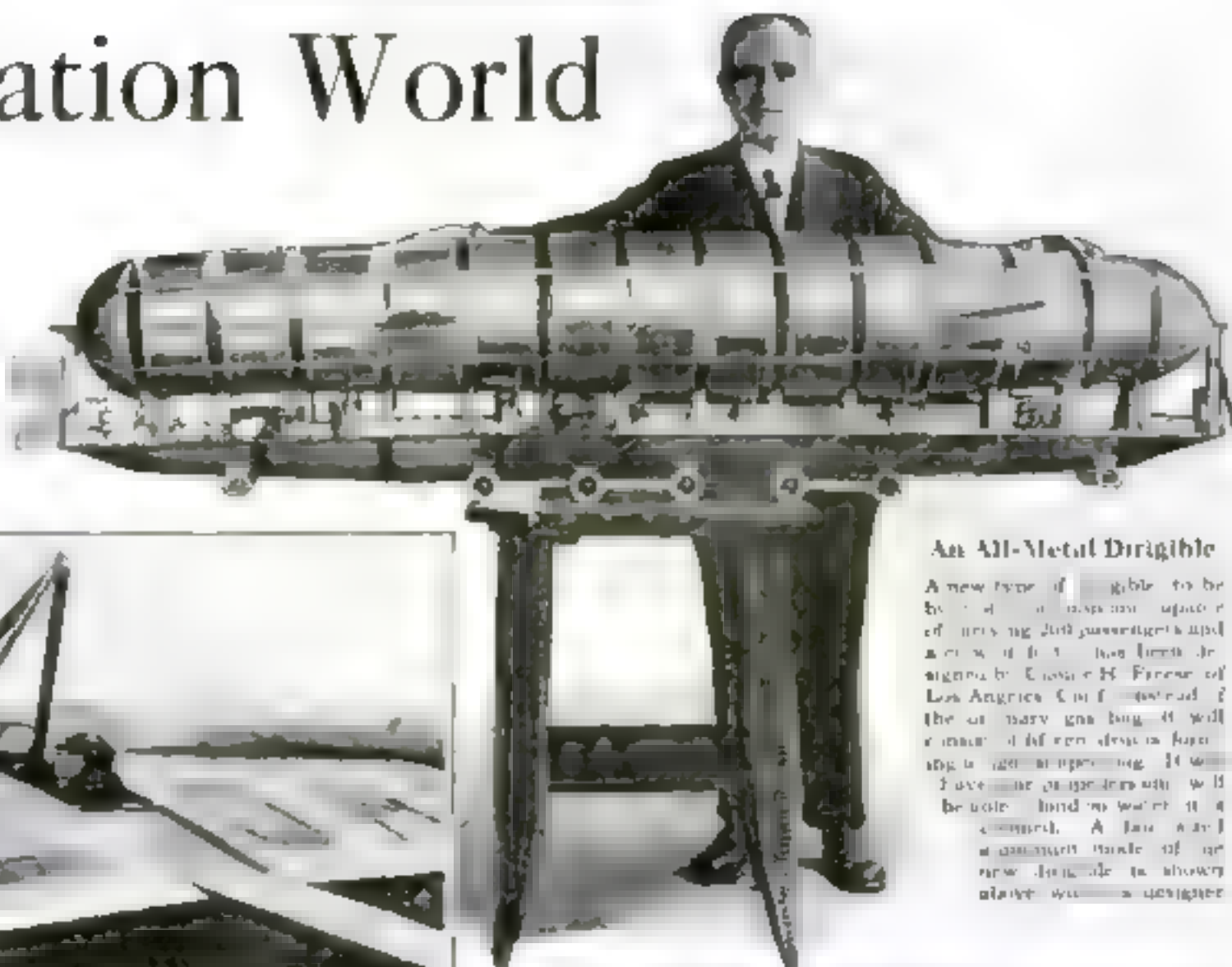
Red Face

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the Aviation World

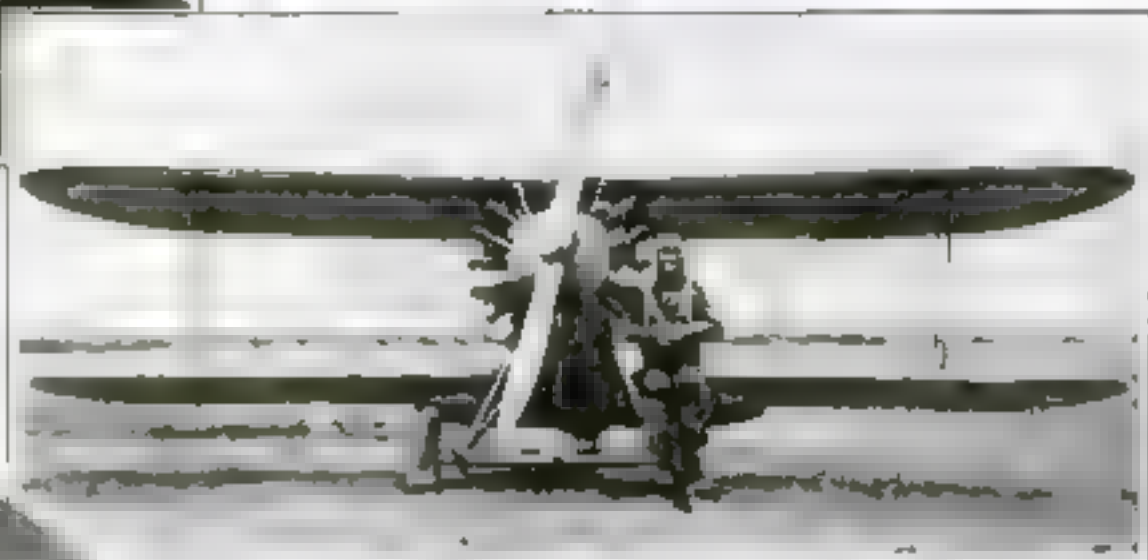
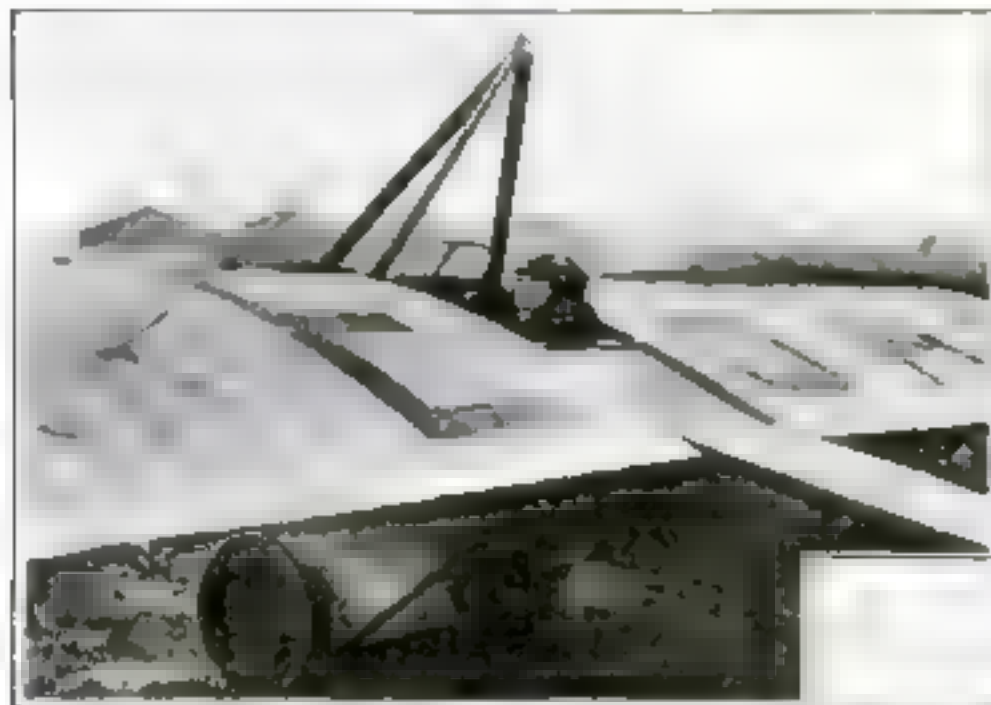
Youngest Air Pilot

Marcel Farman, son of Maurice Farman, the French air force officer, is probably the youngest pilot in the world. He is only seven years old and his father took him to his first flight. He is now in a French air force training camp at his own expense.



An All-Metal Dirigible

A new type of dirigible to be built in the United States will carry 200 passengers and a crew of 100. It will be designed by Louis H. Fieser of Los Angeles. Calif. Instead of the ordinary gas bag it will consist of 100 metal bags, each 100 feet long and 10 feet wide. It will have no propellers and will be able to land on water or a runway. A few days ago a number of the new dirigible was shown at the Los Angeles Exposition.



New Instrument Board

A new type of instrument board for airplanes has been designed by the Army. It is a circular board with a number of dials and gauges. It is designed to be used in the cockpit of an airplane. It is the first of its kind.

A Navy Scout Plane

The Scout is the name of a new Navy scout plane. It is a biplane with a number of features. It is designed for scouting and reconnaissance. It is the first of its kind.



The Modern Way of Returning from the Hunt

The airplane is the popular means of transportation with San Francisco duck hunters, who travel to and from the hunt by plane. The picture

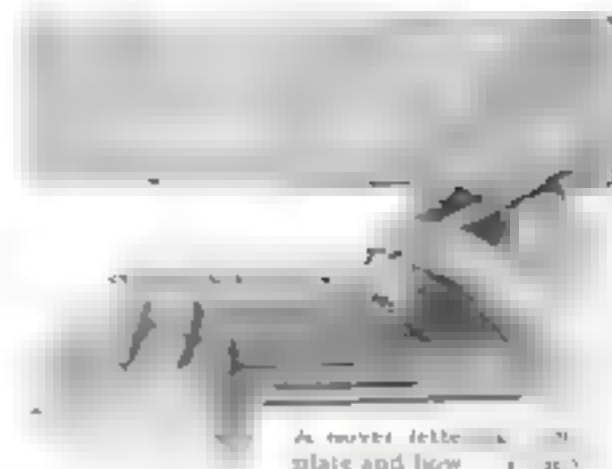
shows a large and happy-looking group of hunters with the game they have bagged posed in front of the plane waiting to be taken home.

Miniature Engine Is Operated by Radio



THE miniature engine and car at the left which the English schoolboys were gazing at so intently that they paid no attention to the camera which snapped them, is operated by radio, and runs swiftly on a track around the table.

It was designed by Major Phillips, an English radio expert, who is holding in his hand the box-like transmitting apparatus that controls the tiny train. This control is very powerful, and can operate 300 yards away.



A novel lettering template and how it is used.

Device Makes Lettering Easy

WITH the aid of the template illustrated above, it is said to be possible for anyone to do neat and even lettering like a professional letterer. The template consists of a transparent strip with a system of perforations along which the point of the pen is run to form the letters of the alphabet and numerals, which can all be made from one template.

Many letters can be made with the same perforation, and no letter requires more than two openings. The template is manipulated by a metal guide, which holds it off the paper and prevents smearing. The work is done with a pen having a funnel-like attachment that holds considerable ink.

The illustrations show the template, and how it is used.

New System for Better Glaze

A SYSTEM of measuring the rate of expansion of the glaze on pottery and enameled ware that will enable manufacturers to produce a glaze that will not crack, has been developed by the experts of the U. S. Bureau of Standards.

Ad-glazed ware consists of a body of clay or metal which is covered with a thin glassy composition entirely different from the base. The two materials expand at different rates when heated and cooled during their manufacture. This strain on the glaze, which is only one two-hundredth of an inch thick, reduces its resistance and makes it brittle. By the use of the new system of the Bureau of Standards, manufacturers will eliminate much of the strain of annealing and produce a glaze that will stand harder wear.

A Novel Cylinder Reamer

THE illustration below shows a new type of automobile cylinder reamer in which an unusual amount of flexibility of the blades is possible. While the reamer is stationary, the blades do not enter the cylinder wall, but rest firmly against it until the device is revolved. During the first quarter-revolution of the reamer the blades gradually are fed to the full depth and held there by spring tension.

The blades are expanded or contracted by a sliding spindle provided with two tapered seats to support the blades. This spindle is controlled by an adjusting nut



Reaming a cylinder with new expanding reamer

smaller engines, normally strong enough to run the car only on a level, but reinforced by a supercharger powerful enough to take it up the steepest hill, will soon be used generally on automobiles, according to G. R. Short of the General Motors. This has been accomplished, he says, with great success on airplanes and racing automobiles, and may soon be done on trucks and pleasure cars, notably reducing the cost of production.

Typical American Home Amazes the French



THE model American home in the American section of the International Exhibition of Household Appliances

at the Grand Palais in Paris, shown in the upper illustration, is drawing large numbers of interested and curious French visitors.

Erected originally in Brooklyn, N. Y., this colonial-type house was dismantled and shipped in crates, as seen in the lower

illustration to France early this year. It is equipped with every device American ingenuity has invented to make housework easier.

Offices on Casters Speed Up Business



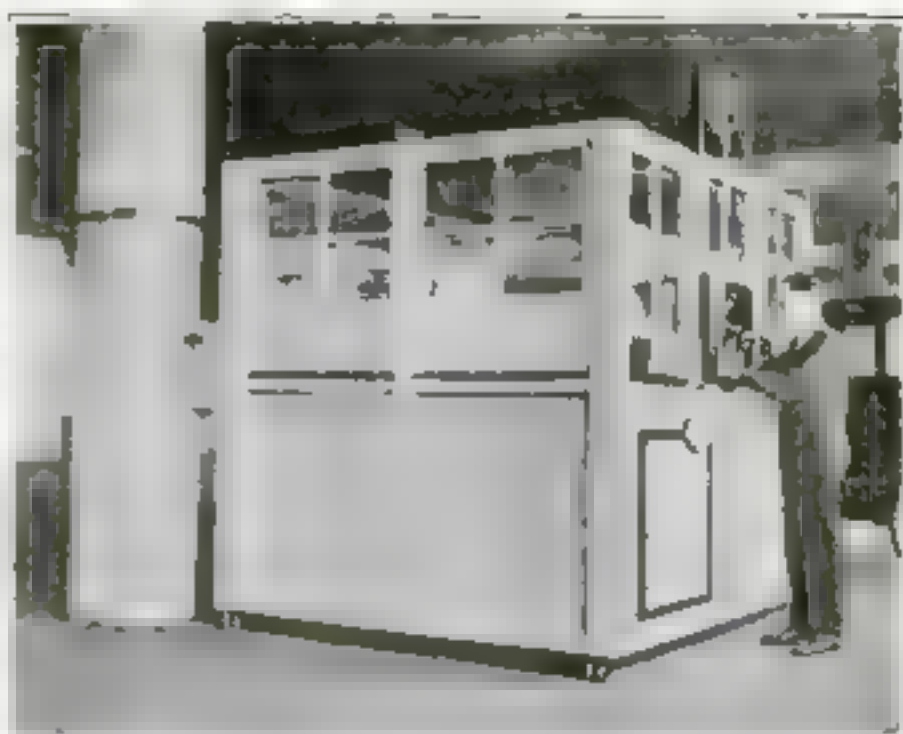
An Aid to Cyclists at Night

RIDING a bicycle at night is a dangerous thing in these days of heavy automobile traffic. Bicycle tail-lights generally are useless in the glare of the powerful automobile head lights.

In England, where cycling is still very popular, experiments are being made to find some way for motorists to see cyclists at night. One method recently tried was painting the rear mudguards white, as the man in the picture above is doing. Bicycles so painted were approached by motor cars, some having headlights full on others with lights dimmed. Results indicate that the paint warning is good.

THE office at the right is one of a number of movable offices recently installed by a San Francisco automobile concern. These offices are mounted on casters and can be moved quickly to whatever part of the floor they are most needed. They can even be run into the freight elevator and taken to another floor.

Each office has four glass sides, giving plenty of light. A roll of telephone wire on top makes it unnecessary to disconnect the telephone when the office is in transit, except when it is moved from floor to floor, and an extension cord for electricity may be plugged in on another socket near the new location.



This unusual portable office can be rolled to any part of the floor, or taken up or down stairs on an elevator. The telephone goes with it.

Reveals Marks on Steel

A SECRET process by which it is said to be possible to discern marks on steel which a criminal thinks he has obliterated has been developed from the study of a mutilated army pistol by metallurgists of the U. S. Bureau of Standards. The process is based on the fact that metals retain internal evidences of their past history.

Complete Railroad System in Small Model



Grandson of builder making adjustments on miniature English railroad said to be most complete model system ever built.

THE wonderful miniature English railroad which is shown in the illustration at the left, is said to be one of the most complete model systems ever constructed. It was erected for the entertainment of his grandsons by Sir Edward Nicholl, who for many years represented Falmouth, England, in Parliament. It contains 3,00 feet of rails and takes up a large part of a great room in Sir Edward's house at Littleton Park near Slapberton, England.

This interesting railroad comprises five lines, four of them main ones, seven engines which are run by steam, electricity or clockwork, and a large number of passenger, baggage and freight cars. It has regular road beds, passenger and freight stations, power houses and round houses, switches and side tracks.

Its equipment, in short, resembles in all respects a real railroad.



Resembles House Fire Escape

PATFORMS that can be stretched from the raised ladder to windows of each floor of a burning building are features of a new type of fire truck, shown above, invented by A. J. Sieber, of Brooklyn, N. Y. These will aid greatly, it is claimed, in the quick rescue of persons trapped in burning buildings.

The ladder telescopes, and when closed does not extend beyond the body of the truck that carries it. In the picture, the inventor is seen operating a model of his safety ladder which, when raised, resembles the fire escapes installed on buildings.

A new method of producing iron from its ore has been developed as a result of the scarcity of coke caused by the recent anthracite strike. The iron ore is ground finely and mixed with fine coal. The mixture is then heated sufficiently to reduce the iron without melting it. The resultant mass then is cooled and run through a magnetic separator.

Making the Cop's Life A Little Easier

A Novel Traffic Signal

The major traffic signal of the future is a hand-operated device which will be used to control the flow of traffic in the city.



He Keeps His Feet Dry

By wearing English riding boots, the policeman can keep his feet dry in the rain.



Prepared Against Fog

A fog signal is a device which is used to warn motorists of a fog ahead.



Boston Police Taught to Shoot

On the firing range, the police are taught to shoot with accuracy.



Roller Skates for Patrolmen

As a means of increasing their speed, the police are using roller skates.

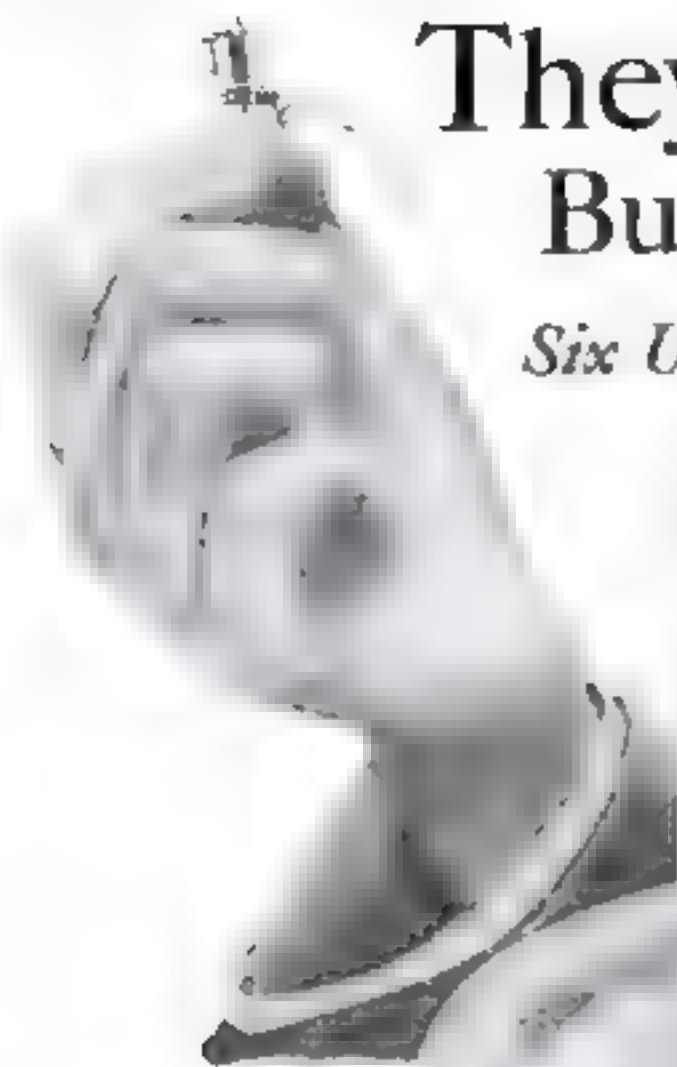
Getting the Bandits

By using a special device, the police can catch the bandits.



They Are *Little* But They Work

Six Unique Small Machines



A Radio Set Built on a Pin

The tiniest radio receiving set ever built anywhere it is claimed, may be seen above. It was constructed on the shaft of an ordinary pin by Rufus P. Turner, a student at the Armstrong Technical High School, Washington, D. C. Have you ever seen one smaller?



Runs Like a Big One

Scarcely bigger than a man's hand is the little motorcycle, said to be smallest ever built, shown with C. W. Daker of London its maker. It has all the parts of a regular motorcycle, and each part functions.

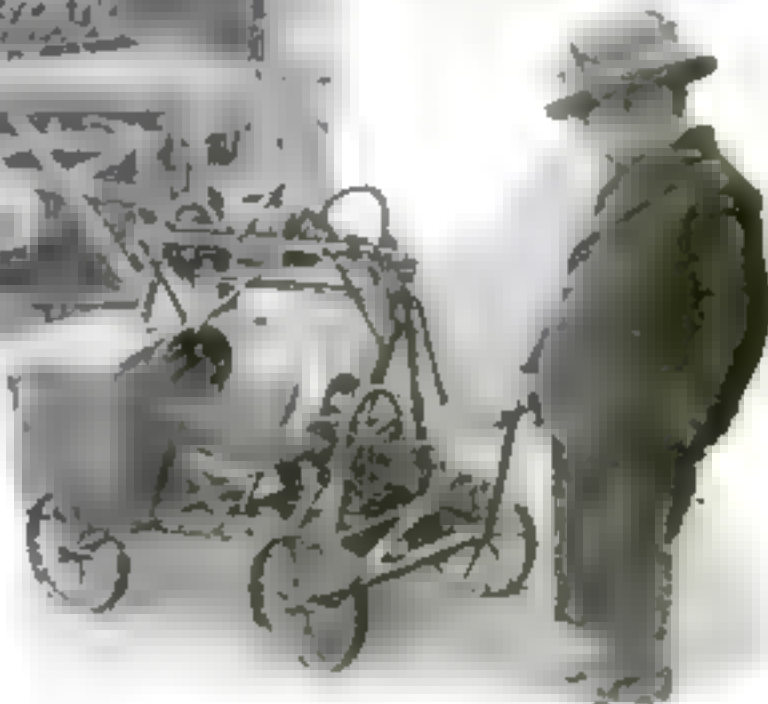
Opera in Miniature

The amazing miniature of the Chicago Opera House, left, built by Harry W. Beatty, of Chicago, contains more than 10,000 parts. Operas are given on it, and all the parts move automatically.



London Hears Tiny Piano

The world's smallest piano, above, was recently heard over the radio by London fans. Only three inches high and about nine inches long, its notes carried hundreds of miles. In shape and action it is exactly like the grand concert piano, of ordinary dimensions, on which it is standing.



Even a Small Boy Can Haul It

Above: The smallest concrete mixer in the world. It is one sixteenth the size of a standard machine and has a capacity of one cubic foot. When recently demonstrated in San Francisco, it turned out standard quality concrete.



None Smaller Made

The car at the left is the smallest complete automobile ever constructed. It is claimed. It was made almost entirely by hand and is an exact replica in miniature of a favorite English roadster. An idea of its size may be had by comparison with its builder, S. J. Stevenson, of Belfast, Ireland, who is standing beside it. It took thirteen weeks of steady labor to make this tiny car.

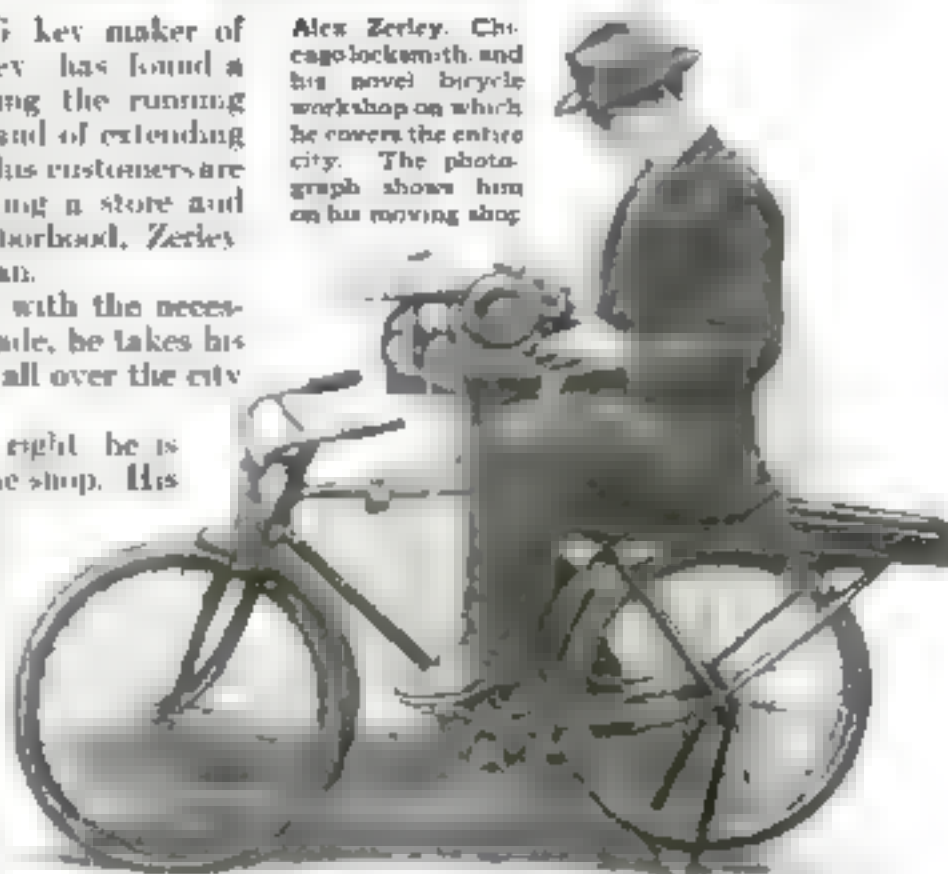
Locksmith Turns Bicycle into Workshop

AN ENTERPRISING key maker of Chicago, Alex Zerley, has found a novel way of minimizing the running expenses of his business and of extending the territory from which his customers are drawn. Instead of renting a store and serving a limited neighborhood, Zerley has hit upon a better plan.

Fitting up his bicycle with the necessary equipment of his trade, he takes his store with him and goes all over the city in search of business.

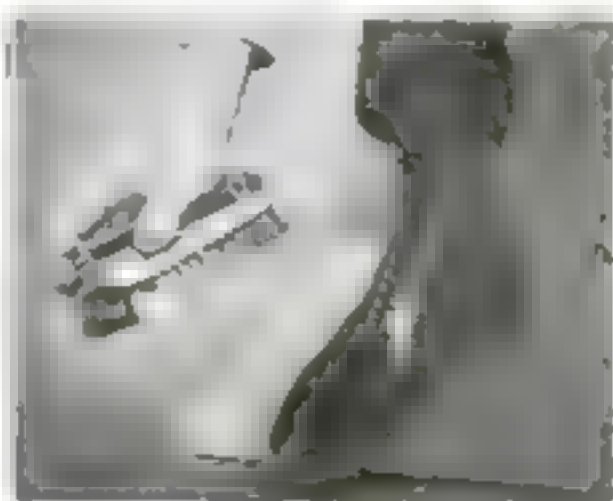
In the picture at the right, he is seen at work in his unique shop. His workbench with cutting wheels is mounted on the cross-bar of the bicycle. When not in use, it is carried on the rack in the rear. The back wheel of the bicycle is lifted off the ground by a stand, and the pedals and sprocket wheel supply the power for his work.

Alex Zerley, Chicago locksmith, and his novel bicycle workshop on which he covers the entire city. The photograph shows him on his moving shop.



A Vest Pocket Safety Razor

THE tiny safety razor here illustrated has been devised for travelers, auto tourists and campers. It takes up little more room than a silver dollar, and three postage stamps easily cover the case in which it is carried. It uses the double-edge safety razor blade of a well-known make. The handle which is short but easily grasped, is formed by two wings that fold back at right angles and hold the guard and the blade firmly in place. The illustration at the top of the column shows how this new razor is used, while below it is seen its unique construction.



A Three-in-One Shoe Polisher

THERE is no longer any need to go hunting for the shoe brush, the daber, or the polish, or to get your hands and the chair all dirty when you want to shine your shoes, if you use the new combination of brush, daber and polish shown at the left, its inventor claims. The tube is enclosed in a metal case attached to the top of the brush, in front of which is a daber. When the tube cap is removed, a twist of the key forces a little polish on the shoe, the daber spreads it, and the horseshoe brush works up a high luster.

How Much Do YOU Know About Science?

NATURE, as it reveals itself in the phenomena we witness every day, is a never-ending source of wonder and the thoughtful man is always seeking the reasons why they happen as they do. Science fortunately explains many of these natural marvels. How many of its explanations are you familiar with? Here is a way to find out. Below are twelve questions on events of common occurrence. The correct answers are given on page 133.

1. What causes waterspouts?
2. Why are birds and mammals covered with feathers or hair, while snakes have no such covering?
3. How much air is there?
4. Why are insects necessary to the growth of most fruits?
5. Do you die instantly when the heart stops?
6. Why are there so many unusual animals in Australia?
7. How do we know just how long to make a yardstick?
8. Why do we believe the moon is very cold?
9. Why is the picture in a camera upside down?
10. How does a crab grow, in spite of his hard shell?
11. What do latitude and longitude mean?
12. Why is sea water different from fresh water?

Concrete Batching Bin Moved on Wheels

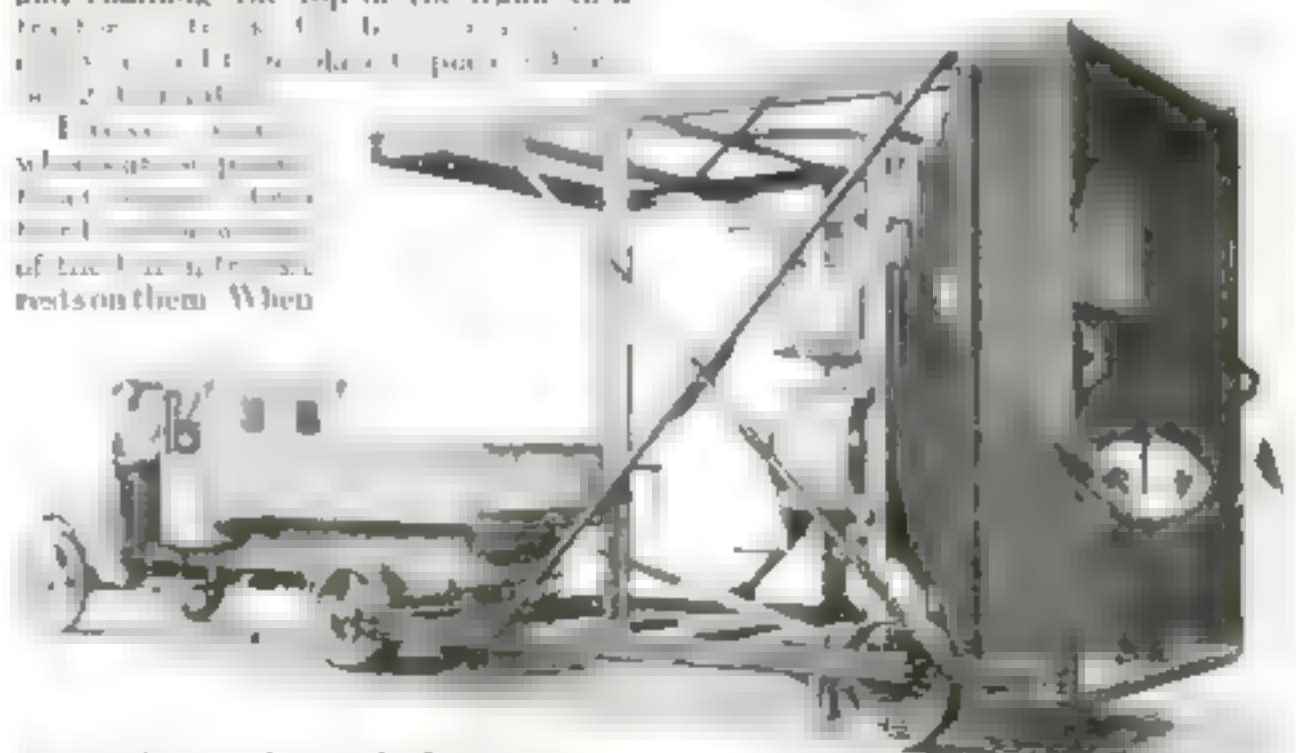
ORDINARILY when a bin for batching concrete is to be moved to a new location, it has to be taken apart. J. N. Heltzel, of Warren, O., thought this a waste of time, and recently worked out an idea to avoid it.

He placed heavy steel wheels near the bottom of one side of the bin frame, and by tipping the batcher over on this side and chaining the top of the frame to a tractor, he was able to pull it to the new location.

It was a simple idea, but it worked. The bin was moved without dismantling, and the wheels were left in place.

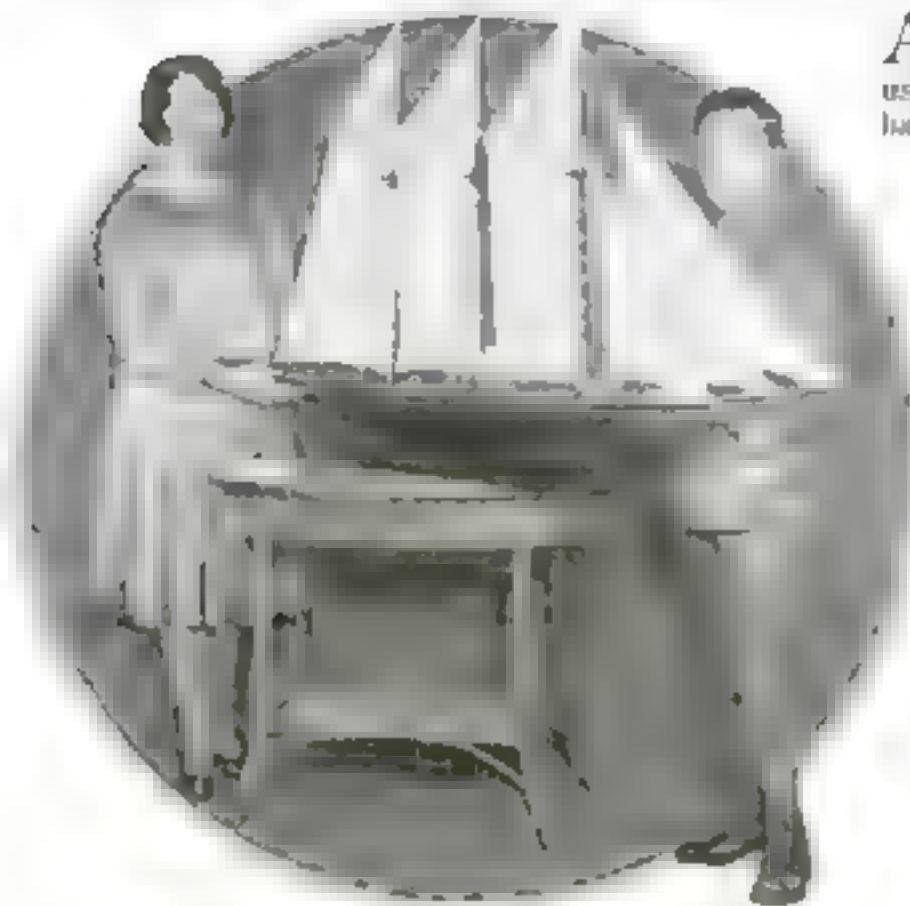
the bin reaches its destination it is again tipped back on its steel base and is ready for work.

The whole operation requires only a few minutes, while it takes hours to take the complicated concrete mixers and steel frame apart and to reassemble them in a new location. In the picture below, the originator is seen standing inside the bin.



Concrete batching bin, ready for moving without dismantling, by the Heltzel method.

Boy's Clipper Ship Model Wins Sea Trip



David Mitchell, New Jersey boy, and his prize ship

A LIKING for the sea and ships, and skill in using his hands and brains, have brought good fortune to David Mitchell, a twelve-year-old Caldwell N. J. boy, shown at left with ship.

For some years David has amused himself making models of famous ships, and recently entered one of these—a three-masted clipper, which he called the *Anne Neilson*—in a prize contest. David's ship was the unanimous choice of the judges for first prize—a sea trip to the Pacific coast by way of the Panama canal.

Experts who have examined the ship say it is a fine piece of work for one so young.



A Vacuum Cleaner for Erasers

DO YOU remember the times teacher kept you in after school and made you clean the erasers for punishment? Or perhaps you had an extremely clever teacher who handed out the job as a special privilege. In either event, you remember how the chalk dust choked you. But it is not done that way any more. It's not sanitary or hygienic.

Instead, there is an ingenious electric vacuum cleaner, seen above, over which the chalky eraser is drawn and quickly cleaned. The dust is collected in a bag.

THE world wool crop today is five times greater than it was a hundred years ago. Cotton shows a greater increase, being twenty times what it was a century ago.

Novel Screen Built Like Shade

THIS new sliding screen is especially good for casement windows that open outward. The roller is mounted at the top of the window frame on the inside, and after the window is locked in the open position in the usual manner the screen is pulled down to cover the opening, just like a shade mounted on a roller.

A modification of the roller arrangement permits installation in new houses so that the screen is concealed completely when not in use.

DECKS of playing cards which bore various dates from 1714 to 1763 were exhibited recently in London. The cards were decorated with illustrations on geography, natural history, and astronomy, and contained much information on these subjects that today is amusing.



Family Sees America in Auto Bungalow

"SEE America first," traveling posters urge. That's just what Mr. and Mrs. W. M. O'Donnell, of Detroit, Mich., wanted to do. They saved for years, and then built a bungalow on wheels, shown below, and started on their long tour.

The unique house has its own electrical and water systems. Its exterior is unusually attractive, and its interior, the owners claim, contains all the comforts that go to make up a cozy home.



In this novel fully equipped bungalow mounted on an auto chassis, and changing its location every day the O'Donnell family of four, of Detroit, is traveling on a seeing-America-first tour

KNOW YOUR CAR

YOU are risking your life every time you drive at night with your headlights in poor condition. The law requires you to keep the headlights on your car in good working order, and that means that the reflectors must be clean and bright, the bulbs of the right candlepower, and the non-glare lenses adjusted so that they spread the beam uniformly across the road. And the lamps themselves must be set so that the light is thrown on the road and not into the eyes of the approaching driver. To get best results from your car lighting system, follow these rules:

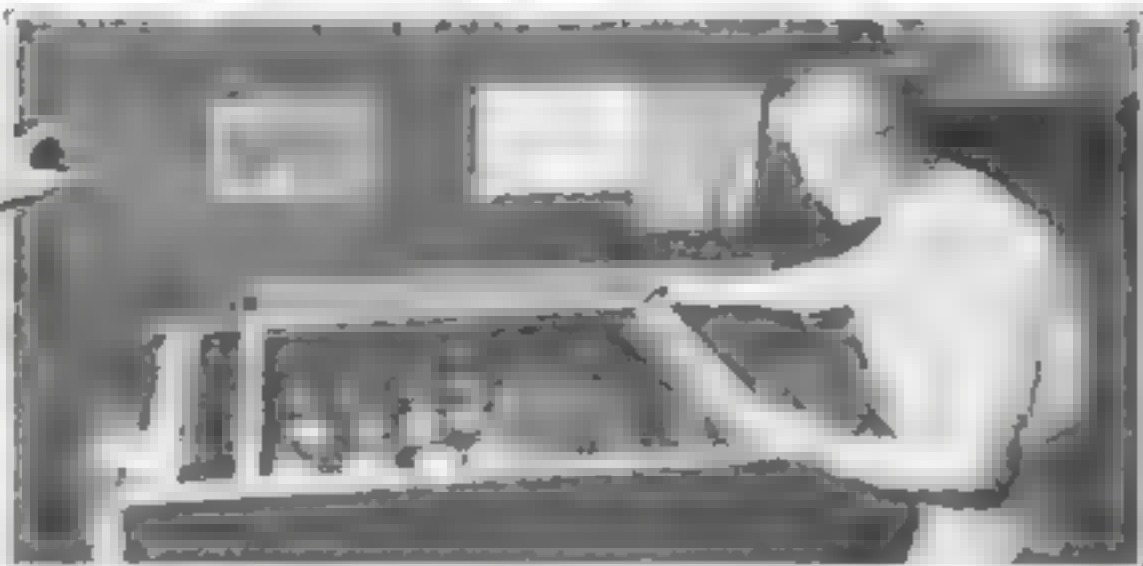
1. Make sure that you have bulbs of good make and of the right candlepower.
2. Dust your reflectors very lightly with a clean silk or linen handkerchief at least once every two or three months, and have them resilvered when they begin to look tarnished or foggy.
3. Keep the lenses clean and set with the word "top" in the right position.
4. Make sure that socket contacts are clean—a corroded contact will affect seriously the brilliance of the light.
5. Keep your tail-light clean, and make sure that it lights up the license plate.

Strange and Interesting



Speeding Up Tennis

Tennis on roller skates is the latest fad of the younger folk in California. The picture shows Miss Dorothy Henry left of Cheviot Hills, on roller skates, reaching for a high ball fast over



The mashier above, combining a tank of floating water colors into colored marble designs for book covers in the Government Printing Office, Washington, D. C., has a job that requires uncommon patience and skill to secure the more pleasing effects.



Popular Hobby for All

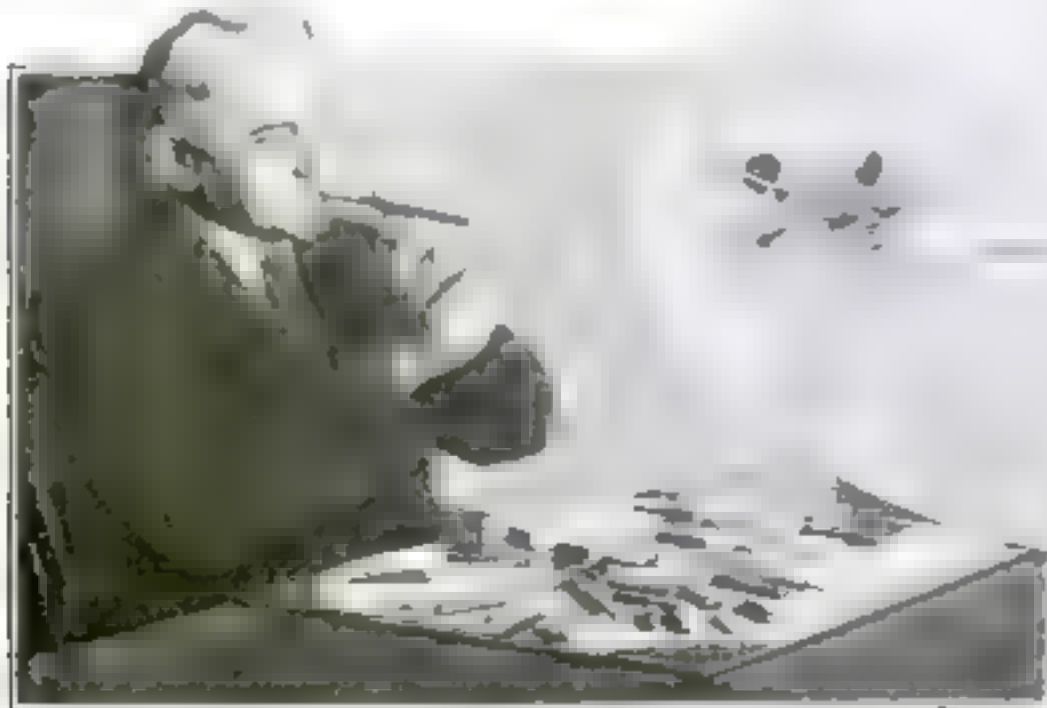
Roller skating is a popular hobby for all. The picture shows a woman on roller skates, reaching for a high ball fast over

Smokes for Living

A man is shown smoking a pipe. The picture shows a man on a bicycle, reaching for a high ball fast over

A Picture Case for Art Lovers

A picture case for art lovers. The picture shows a man on a bicycle, reaching for a high ball fast over



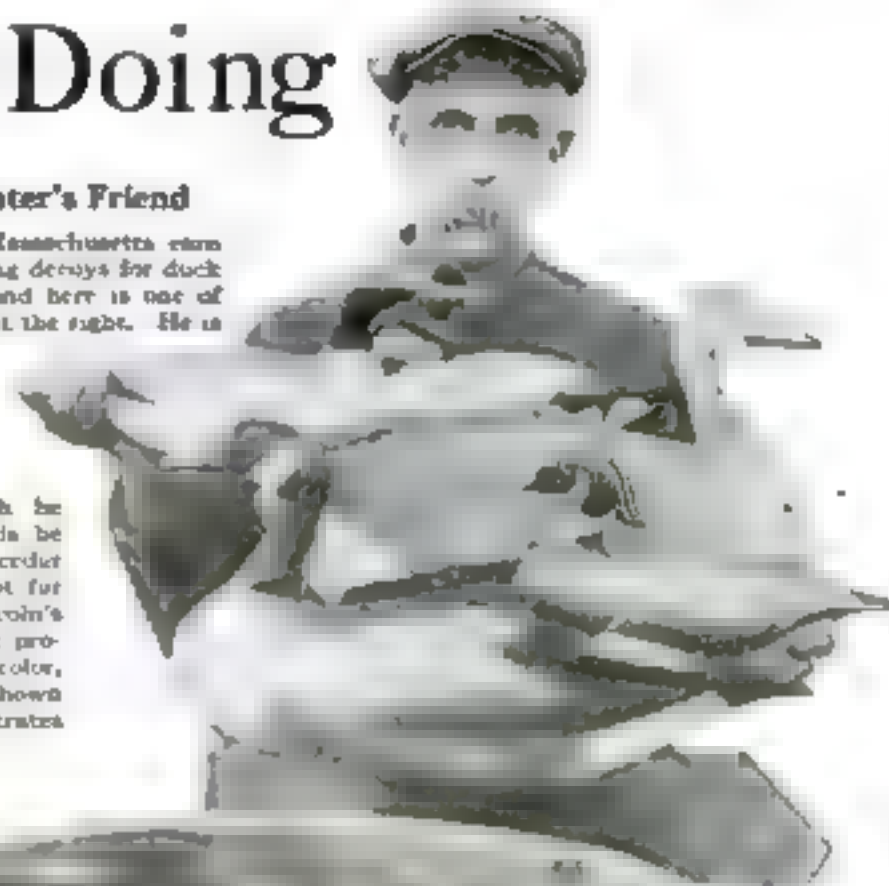
A New Use for Cowboy's Lariat

A new use for cowboy's lariat. The picture shows a man on a bicycle, reaching for a high ball fast over

Things People Are Doing

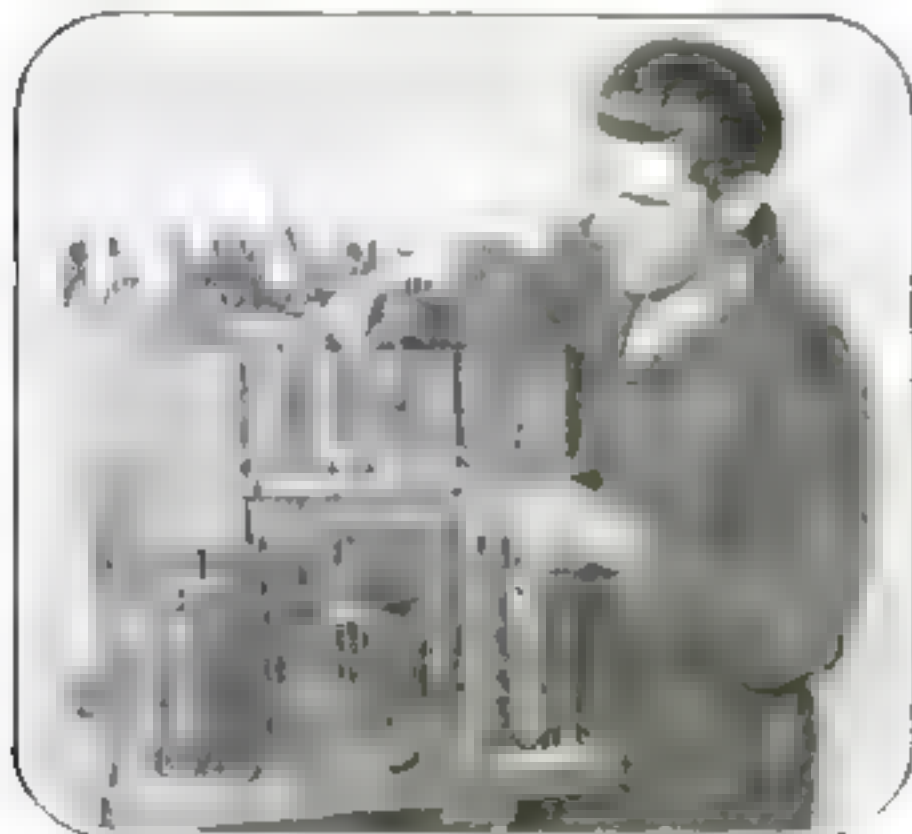
The Duck Hunter's Friend

Only two men in Massachusetts earn their living by carving decoys for duck hunters, it is said, and here is one of them in the picture at the right. He is Joseph Whiting Lincoln, of Accord, in old Plymouth county which is noted for its duck shooting. All the material from which he makes his duck models he himself cuts from cedar trees in a swamp not far from his home. Lincoln's creations are real art products in form and color, as the model he is shown with amply demonstrates.



Curious Tree-Top House Doomed

This unusual home in the branches of a spreading tree on the outskirts of Manassas, N. J., has been for five years the home of Thomas J. Ogburn. Now it is marked for destruction because he stands in the path of a new city street, and Ogburn is compelled to seek other quarters. Its owner is seen sitting up top of the ladder in what serves as the front door, enjoying pipe and pipe.



He Counts 3,200 Wheels a Day

Michael O'Connor, of Council Bluffs, Iowa, above, says he is the world's champion wheel counter. Every day for the past seventeen years he has checked up 3,200 wheels for the Union Pacific Railroad, which makes a wheelage charge for the use of its bridge over the Missouri river. O'Connor, it has been estimated, has counted 198,500,000 wheels during his long term of service.

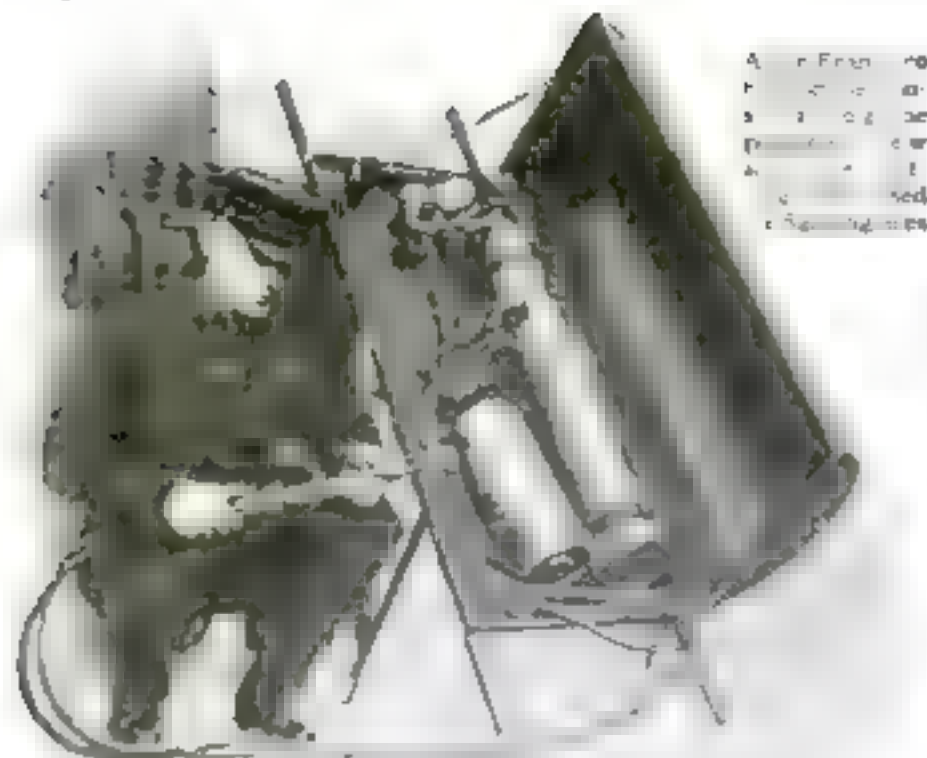
Good Head Work!

At the right is one man at least who uses his head. He is Alexandre Palty of Paris, a circus performer who is shown in one of his favorite stunts. He is the only performer, it is said, who can walk on his head either on level ground or down a stairway.



A Tiny Castle Spare-Time Built

This splendid miniature replica of a medieval castle in Switzerland was finished recently by André Cros, shown with his model, a mechanic living in Los Angeles. It was built in his spare time, and took him one year to complete. A perfect reproduction to the smallest details, it is made throughout of hammered copper. In the courtyards are fountains which are kept playing by a small motor operated by a revolving squirrel cage.



Acetylene Torch for Firemen

THIS novel acetylene cutting outfit, built by the San Francisco fire department recently, is arranged with handles at each end so that it can be carried like a stretcher by two men. When brought to the place where it is to be used, one end is lowered to rest on the ground. A tripod fastened to the back of the case is opened and set up so that the outfit is supported as shown in the picture above. When the cover is opened, not a second is lost for the equipment is ready for instant use.

A Gymnasium for Rainy Days

CHILDREN will find a whole gymnasium virtually contained in this device, which fits on any doorway and



can be put up or taken down quickly without drilling holes or marring the wood. Tongs with rubber tips hold the swing, trapeze bar and two rings.

The hanger is so constructed that the heavier the weight on the ropes the tighter the steel tongs grip the door jamb. Each attachment—swing, trapeze bar or rings—can be snapped on or off quickly.



Wobble-Walk for Exercise

AT THE left is shown a new way of exercising the back, arm and leg muscles, called "wobble walking." You stand on the crossbar of this curious device, and wobble on the sticks by moving first one leg and then the other.

This wobbling motion causes the body to move forward and backward as you may wish. Though intended principally as a plaything for children,

it is said to afford good exercise for grown-ups and to be an aid to taking off extra weight. It is of simple construction and has no springs or mechanism to get out of order. Its use will probably be as extensive as that of the "pogo" stick, which has enjoyed such popularity.

Triangle Acts As Third Hand

EVERYONE who has tried hurriedly to get a heavy elastic band over a good-sized package with one hand, while holding the package with the other, has wished that he had three or four hands. The new device which is pictured on the right is said to make such a wish unnecessary. It acts like a third hand, helping to stretch the elusive elastic.

It consists of a wire triangle attached to a metal base that can be fastened to a table or desk. A package of rubber bands encircles the bottom of the triangle. The package is placed on the top of the triangle, and a rubber band pulled up and stretched wide enough to go around it easily. This operation takes only half a second, it is claimed, while the old way required from eight to ten seconds.

Horse Races on Shipboard

AS A new deck sport, ocean liners recently have added horse racing with wooden horses and jockeys whose movements are controlled by throwing dice. The horse is moved forward on a track chalked on the deck as many squares as numbers on the dice. The picture shows a fan astride her choice in a race.



PHOTOGRAPHY without plates or film is possible, it is claimed, by using a new invention by a South African chemist. Pictures are taken directly on sensitized paper and the image developed in a few seconds. Apparatus is included for developing and printing the photograph. The image is reflected directly on bromide paper beneath the lens. Pictures can be taken with this blindless camera a half the time and for a fourth the cost, it is claimed, of making them now.

Fare Register Prevents Losses

A FARE register recently invented records cash fares, gives the passenger a receipt, and keeps a mechanical audit for the conductor. It consists of a round-top metal box six inches in diameter and six inches high. When the conductor pulls the proper lever, a ticket is issued that contains the name of the passenger's station, the time and the price. When the passenger is leaving the train, he returns the ticket to the conductor.

Inside the machine is locked another record that duplicates the tickets, and registers the conductor's number. This slip meter is inserted with cash and tickets.

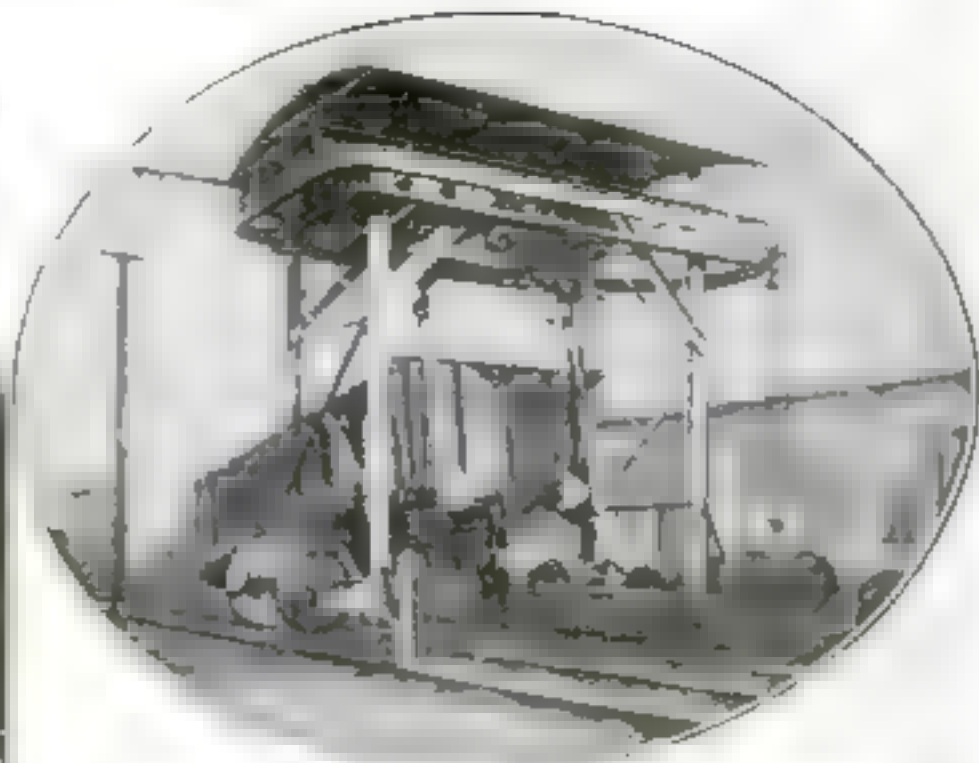


Helps to Slip on Elastics

This office device stretches rubber bands so that they can slide with ease over packages.

Coupler Wins Government Prize

THIS coupler, below, perfected at the Krupp works, was recently awarded a prize by the German government. It is intended for wagons or motor trucks. Lessen is the danger to the pointsman, and saves much time. It is so constructed that a bar attached to one truck fitting into a U-shaped part on the other. Both parts move easily. A pin locks them together.



For Close-Ups and Long Shots

IN TAKING motion pictures, a close-up and a long shot often buy a picture of the same scene. To get both has been necessary hitherto either to make a second exposure of the same scene, or to repeat the movement of the camera. In either case the picture is not exactly alike, since the movements cannot be repeated exactly with two cameras.

John W. Boyle, inventor of the stop at Hollywood, California, has invented a device that solves this problem. It is a metal block clamped to the top of one camera which supports a second camera. The lenses of both cameras are set to cover the same field. The bottom camera, fitted with a wide lens for a long shot, is hand cranked, while the top camera, fitted with a long focus lens for close-ups, is motor-driven. This arrangement makes it possible to secure at the same time two perfectly matched negatives. It also doubles the range of the camera in taking panoramas.

John W. Boyle, inventor, and his new double movie camera.



A Cleaner with Dust Blower

FOR hotels, office buildings, hospitals and light dust removal in factories, a new type of semi-heavy portable vacuum cleaner has been devised. Larger than the ordinary household machine and smaller than heavy-duty factory pneumatic sweeping systems, this in-between machine is expected to fill an important gap. The machine, which weighs only 105 pounds, can be wheeled from floor to floor. Besides the usual cleaning feature, it has a convenient dust blower attachment which can be used for blowing dust from inaccessible places such as the under parts of electrical apparatus and telephone switchboards. The picture, above, shows the new cleaner and the carriage on which it is mounted.

A Substitute for Turbines

A GERMAN electrical engineer, Dr. Paul Walter, of Berlin, has devised a thermomagnetic electric generator which he believes will supplant steam-driven turbines for generating electricity. The device consists of a heavy soft iron ring magnetized by an electric current. In the center of the ring is hung an induction coil. As the ring is heated and then allowed to cool, an alternating current is induced in the coil. The heating is controlled automatically.

Novel Crane for Lifting Cars

A GERMAN railroad has constructed a novel crane seen above for use in changing wheels, brakes, couplings and rods, and in making other repairs on the bottoms of its cars. This powerful machine lifts one end of the car to the height desired and holds it in that position until all the work is done. It carries extra wheels and other equipment on its sides, and has a circular track near its top, fitted with rollers and tackle for moving the necessary materials into position.

It is operated electrically from a three-phase system which may be seen in the picture. The crane is covered with a roof which shelters the workmen from the weather. Much time, it is claimed, is saved by this machine, which permits repairs to be made in 15 minutes.



A Right-Angle Screw Driver

FOR use in close quarters, such as corners, where there isn't room to handle an ordinary screw driver, an ingenious new tool which is shown above has been recently invented. It is called a right-angle ratchet screw driver, and its blade, made of fine tool steel, is reversible. To remove a screw, the blade is taken out of the holder, fastened in the reverse side of the tool, and then turned as before.

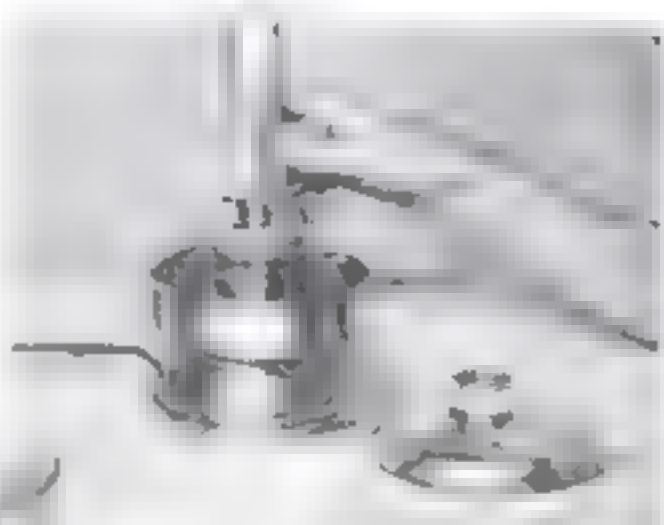
A MACHINE that plants cabbage seedlings with considerable speed has been invented by Abbé Barle, the parish priest of the village of Treize Vents, near Nantes, France. It consists of a moving arm that places each seedling in a hole and another attachment that covers it with earth. It saves, it is claimed, nine tenths of the time that is usually employed in planting cabbages.

New Inventions

Combination Tea Wagon and

For Better Sweeping

To make a soft broom stiff, for better sweeping, and to prevent straws from working loose and dropping out the broom guard shown in the picture below was recently invented. It consists of two aluminum pieces pressed on to the sides of the broom and connected by strips of wide elastic.



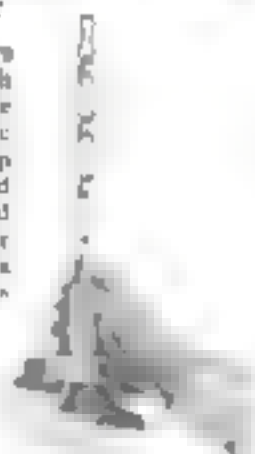
Dinner Wagon and Dining Table

This ingenious dinner wagon which, by releasing a catch, can be made into a table for six persons, is the invention of an Englishman. The wagon, which has three tiers, can be set in the kitchen, pushed into the dining room, and then changed into a table. Its action is smooth, so that nothing whatever on the table will spill.



A Novel Humidifier

A new idea in humidifiers is shown above, in which vapor is formed by the aid of an ordinary electric light bulb and a lamp wick. The bulb is wired into the wick heats and evaporates the water drawn up by the wick. Its chief use is to keep garments moist, but it can be used as a vaporizer or room deodorizer.



Tying Made Unnecessary

Most people cannot tie a knot in rope that will hold. So the clothesline sag or fall, and down comes the washing. The little rope holder at the right keeps the line tight without knots and prevents it from slipping.



Notched Ruler for Skirt Hems

For the home dressmaker, a new ruler which makes measuring a hem easy work has been recently designed. Every inch on it is notched so that when the hem of the skirt falls on it, it indicates what distance the skirt is from the floor. It is held vertically when used.



Has No Parts to Lose

Electric light globes will be kept cleaner if equipped with the new fixture illustrated above. It has no screws or clamps, and the globe can be slipped off quickly and easily for washing when necessary.



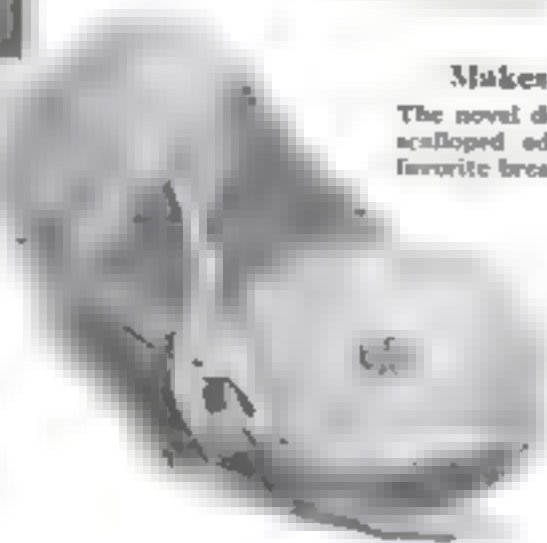
Shoe and Clothes Brush in One

The combination lamb's wool shoe polisher at the left, which carries on its back an efficient little clothes brush, should please travelers especially. It can be tucked handily in a small bag or even carried in the pocket.



Makes Grapefruit Attractive

The novel device at the left puts a pleasing scalloped edge on grapefruit, making this favorite breakfast fruit even more attractive.



A Cream Whip That Doesn't Spatter

You do not need to worry about getting spattered. It is said, if you use this remarkable cream whip, shown above, put on the market recently. The manufacturer claims that with this whip the cream will be beaten stiff in twenty seconds. A baffle prevents spattering.

Keeps Water Hot

Water can be kept boiling hot three hours, it is claimed, in this new thermos jug recently invented in England. It is built on the principle of the thermos bottle, and is made of sheet iron. A vacuum chamber accounts for its thickness. The lid contains a vacuum chamber also shown right.



for Busy Housewives

Dining Table; and Other Novel Articles



Cores Grapefruit

One bite of the new device illustrated below, and out comes the core of the grapefruit, seeds and all, quickly and without fuss. With handles closed the corer is pressed with a slight twist into the fruit. Opening the handles closes the knives a cup-shaped around the core. When the cutter is pulled up, the core comes with it, being held firmly in the cup formed by the blades.



Shaker Has Self-Sealing Top

Dust and moisture cannot enter the shaker because of a self-sealing top. The shaker is made of a material which is impervious to dust and moisture. The shaker is made of a material which is impervious to dust and moisture. The shaker is made of a material which is impervious to dust and moisture.



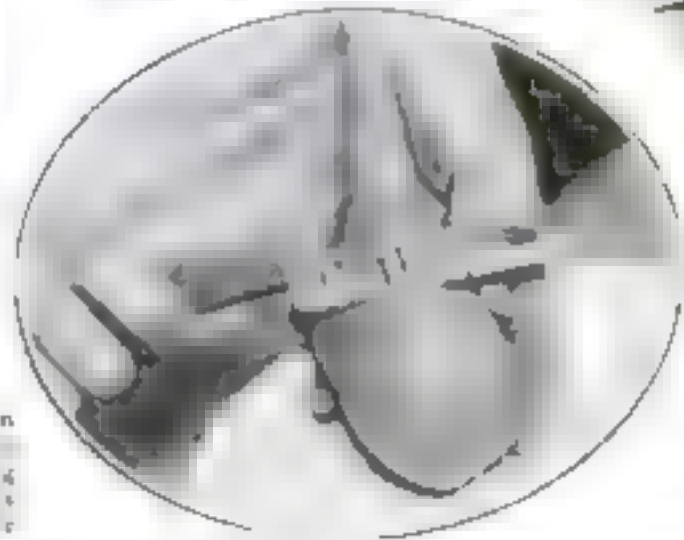
Novel Vegetable Knife

For slicing, cutting, and dicing vegetables, this knife is a real find. It is made of a material which is impervious to dust and moisture. The knife is made of a material which is impervious to dust and moisture. The knife is made of a material which is impervious to dust and moisture.



Unique bucket for Scrubbing

Scrub and mop water for scrubbing and mopping. The bucket is made of a material which is impervious to dust and moisture. The bucket is made of a material which is impervious to dust and moisture. The bucket is made of a material which is impervious to dust and moisture.



This Gun Lights the Gas

A gas burner is lit with a single shot. The gun is made of a material which is impervious to dust and moisture. The gun is made of a material which is impervious to dust and moisture. The gun is made of a material which is impervious to dust and moisture.



Glass Jars for Ice Box

The round refrigerator set is composed of a number of glass jars. The jars are made of a material which is impervious to dust and moisture. The jars are made of a material which is impervious to dust and moisture. The jars are made of a material which is impervious to dust and moisture.



Keeps Down Your Water Bill

The garden hose attachment shown above will save you a lot of money. It is made of a material which is impervious to dust and moisture. The attachment is made of a material which is impervious to dust and moisture. The attachment is made of a material which is impervious to dust and moisture.

Hints for Radio Beginners

What Radio Symbols Stand For

Their Knowledge Aids in Correct Wiring

IF YOU are a beginner in radio, you will find a knowledge of the symbols used in wiring diagrams a big help to you in wiring up the radio set you are building. Picture diagrams are good. They show you, in most cases, where the instruments should be located in building the set, but wiring a set just from a picture drawing will not be of much help to you in your study of the fundamental reasons as to why radio operates.

And radio symbols are really so easy to understand that it will be well worth your while to study them. In most cases the symbol is just a simplified and conventionalized drawing of the radio part that it represents.

Look over the drawings on this page. The first two at the top of the left hand

column are for the antenna and the ground. Once you have these symbols fixed in your head, you run no chance of connecting the wrong wire to the antenna or ground binding post of your set.

A B C's of Radio

MUCH of the satisfaction you obtain from your set depends on the quality and condition of your B battery.

The life of a B-battery depends on the use that is made of it. If you have a multiple tube set or use power tubes, under normal use you will probably have to get a new battery every four to six months. With a one or two tube set or with a larger set that is used only an hour or two a day, the battery may last a year or more.

Your set will warn you of a B-battery that is nearing exhaustion in lessened volume and scratchy noises that resemble the sound of static. When you hear these noises, test the battery according to the directions given last month, and if the voltage is low, replace the battery.

Next is the symbol for a plain radio tuning coil. Below that is the symbol for two tuning coils or inductances that are arranged so that they interact magnetically. In other words, a radio frequency current flowing in one will cause a similar current to flow in the other. If the two coils were not supposed to act with each other, the symbols would be drawn at right angles or at some special angle—as in diagrams of radio receivers of the neutrodyne type.

AT THE top of the right-hand column is the symbol of the variable condenser, and below that is a variable condenser connected across the terminals of a tuning coil. In looking at a picture wiring diagram of these two parts, you would have to follow along each line that represented a wire with your eye to be sure where it actually terminated. One glance at the symbol drawing would settle all doubt.

In the same way, the symbol for the grid leak and condenser can leave no doubt in your mind as to just how the leak and condenser are connected together and to the rest of the circuit.

The symbol for the tube socket shows, in the same way, just which elements in the tube are connected to the different parts in the circuit.

The constructional articles that appear in *POPULAR SCIENCE MONTHLY* showing

how to build and wire radio sets, ordinarily include both a picture diagram and a theoretical wiring diagram employing the conventional radio symbols. By carefully comparing these two kinds of drawings, part for part, you will find it an easy matter to learn the symbols. Then when you start to wire a radio set, you will not have to depend on the markings on the binding posts of tuning coils, for instance. If they do not seem to fit the wiring diagram you are trying to follow, you can check up on the way the coils are connected and wire accordingly.

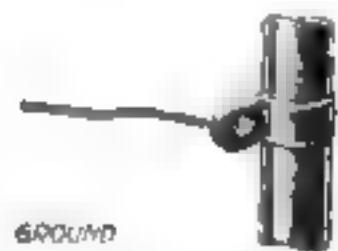
And after you have mastered symbols as used in the conventional circuits, you will be able to analyze any new circuit you run across and see how it differs from the circuits with which you are familiar.

THE SYMBOL

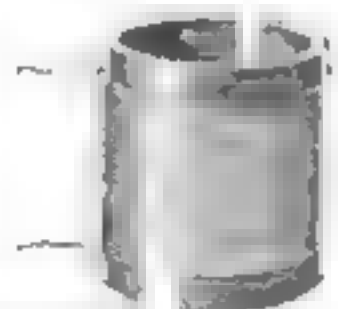
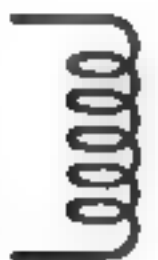
WHAT IT STANDS FOR



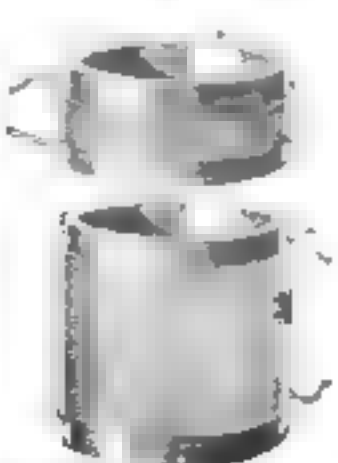
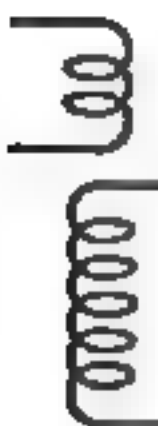
ANTENNA



GROUND



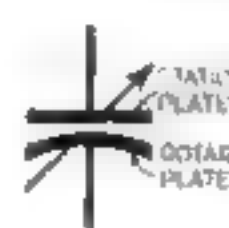
SIMPLE RADIO TUNING COIL



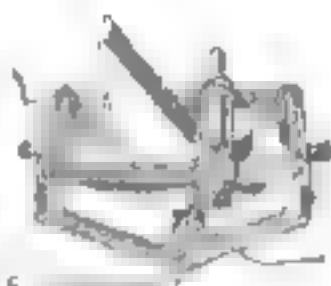
COUPLED RADIO TUNING COILS

THE SYMBOL

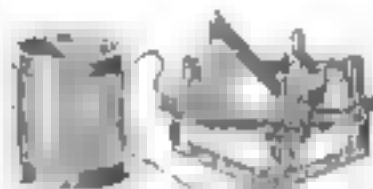
WHAT IT STANDS FOR



TATUARY PLATES
ODIARY PLATES



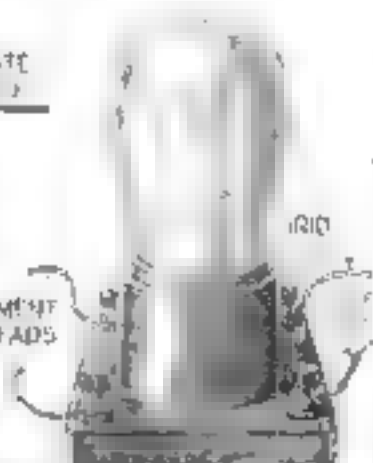
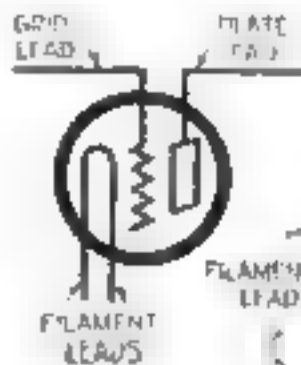
VARIABLE



TUNING COIL AND VARIABLE CONDENSER



GRID LEAK AND CONDENSER



VACUUM TUBE SOCKET

How to Solder Radio Wiring Joints

Few Simple Rules Make It Work Easy

By ALFRED P. LANE

YOU can solder every joint in wiring up a radio set and do just as good a job as a professional electrician. It's just a matter of learning how it should be done and then practicing a bit until you get the hang of it.

Like every other mechanical operation, you cannot do a good job unless you have the proper tools and materials to work with. Fortunately, soldering equipment is inexpensive. You will need a good soldering iron, either a plain iron that must be heated over the kitchen range or the electrically heated type. The latter is better, perhaps, for radio wiring because so many solder joints must be made in succession, and if you have to wait each time for the iron to heat again a considerable amount of time is lost.



Keep Renewing the Supply of Solder on the Point

The resin melts and runs into the joint from the strip solder. It keeps the solder flowing properly on the point and joint, and prevents the formation of a film over the metal.

polish the surfaces clean with sandpaper.

After you have purchased the necessary equipment, practice soldering short pieces of wire together before you attempt wiring a radio receiver.

Figs. 1, 2, 3 and 4 show the successive steps in making a good soldered joint between two pieces of ordinary bus wire.

press the strip solder against the iron. As the solder melts, it should flow onto the surface of the iron as well as onto a piece of glass. Rolling the solder over the surface of the iron will assist the process. If it rolls off in globules like water on a hot stove, apply more soldering paste or file the point again and repeat the operation. Continue until the whole point of the iron is brightly coated with solder.



Fig. 1. Bend the wire this way for a strong joint in radio work.

In addition to a good soldering iron, you will need solder and some sort of flux to make the solder flow onto the bare metal surfaces. The best form of solder for radio work is "strip" or "wire" solder, which should be half tin and half lead. Cheap solder contains too much lead and is very difficult to work with.

The soldering flux prevents the formation on the metal surfaces of thin coatings of oxide which hinder the solder from flowing into the joint properly. For radio work you should avoid any soldering flux or paste that contains acid. The soldering pastes put up in small cans for electricians' use are good, or you can buy strip solder in the form of a hollow wire filled with resin. Resin makes a fine soldering flux, as it hardens quickly and does not creep over the surface of the work.

ONE point must be remembered: it is impossible to make a good soldered joint between two metallic surfaces if they are covered with corrosion. So unless you are soldering new, clean bus wire to the soldering lugs on radio instruments equally new and bright, you should



Fig. 2. Apply a little soldering paste with the end of a match unless you are using resin core "strip" solder. It has its own flux.

Fig. 3. Apply the hot tinned iron and hold it till the solder flows into the joint. Do not remove too quickly.



And the process is the same for any other soldered joint. In these photographs, the wires and the end of the soldering iron are enlarged more than three diameters.

But before you start soldering, you must prepare the soldering iron, which always is made of copper. First, with a smooth file, go over the surface of the point until you get down to the bare, clean metal. Then heat the iron, apply a liberal amount of soldering paste, and

FIG. 1 shows the best way to arrange a joint between two wires. Shape the end of a scrap of wire as shown in photo and then apply a small amount of soldering paste to the joint with the end of a match as shown in Fig. 2. Now apply the point of the hot iron to the joint, as shown in Fig. 3. If you have properly tinned the end of the iron, there should be a drop of solder hanging from the point. As this solder touches the soldering paste there is a sizzling noise and the solder runs down and between the two wires.

Hold the iron in position until the whole joint is heated thoroughly. Poor solder joints are caused generally by too cold an iron or by failure to keep the iron in contact with the joint long enough. After the solder has flowed in properly, remove the iron and you will have the soldered joint shown in Fig. 4. Wipe off all excess soldering paste.

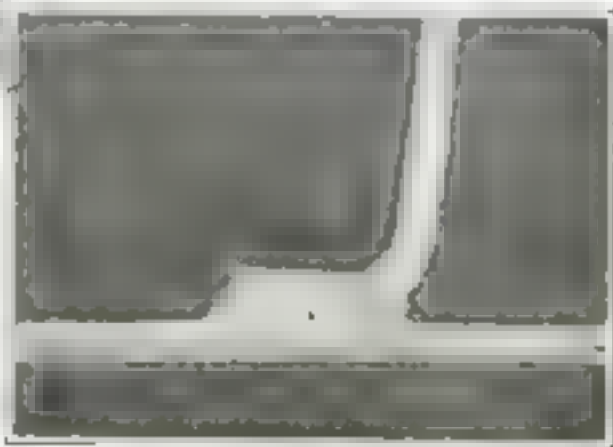
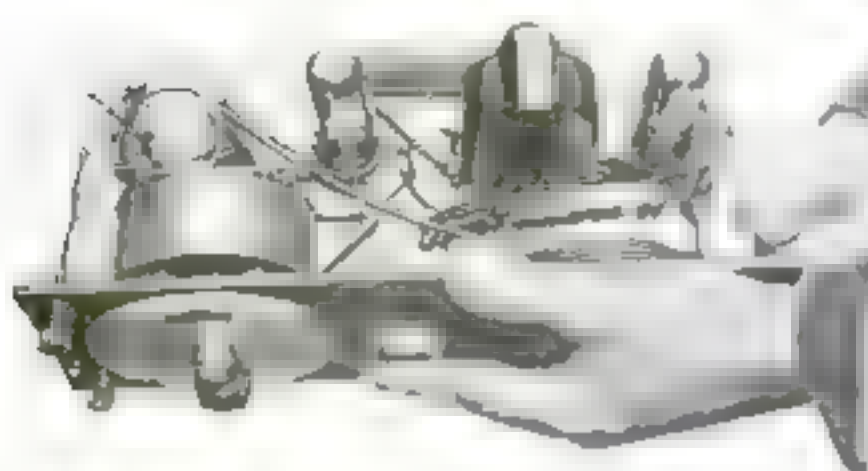


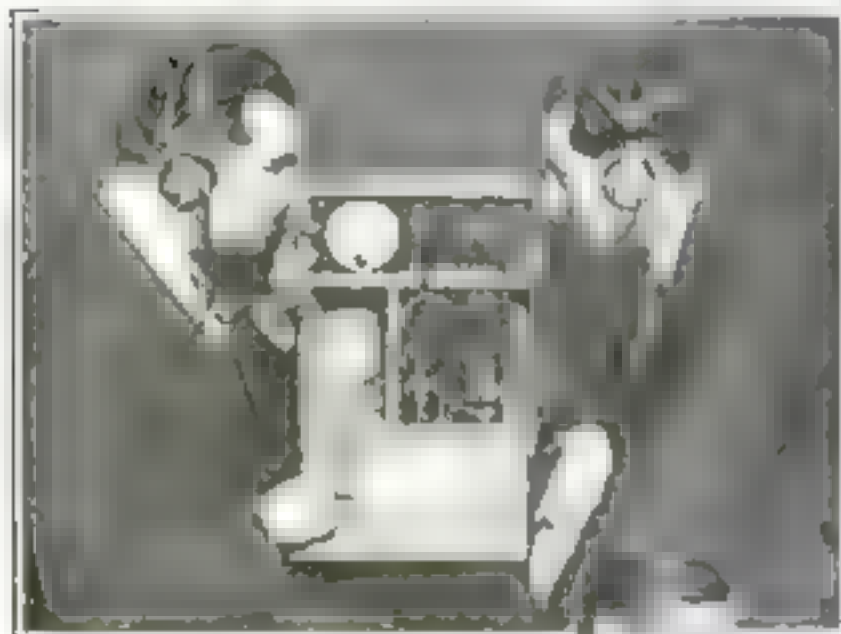
Fig. 4. The completed joint has minimum electrical resistance and will not come loose.

New Sidelights *on* Radio

Broadcast Novelties; Unusual Sets; Interesting People



Off Aboard? Here's the Train at Station WH-1

[illegible]

An Explorer's Set

[illegible]

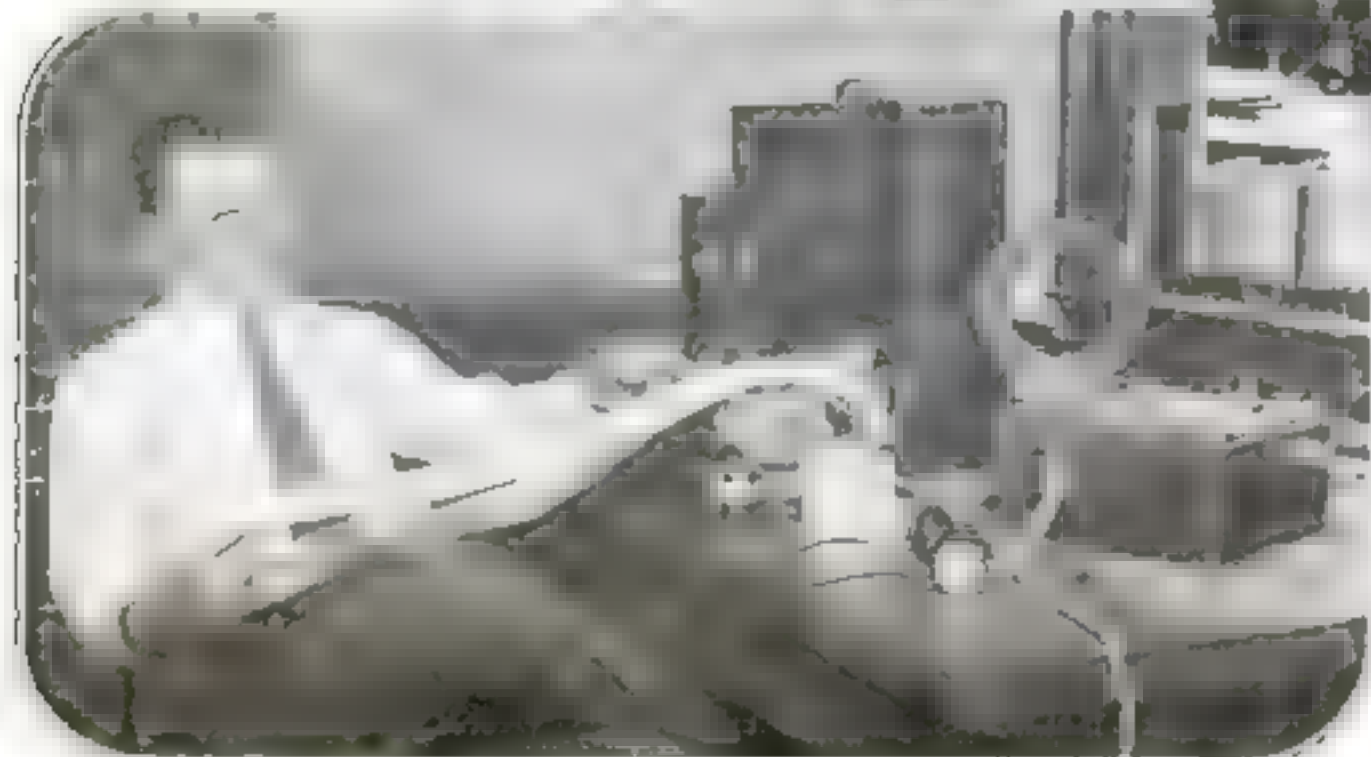
New Timing Control

[illegible]

'Funding n' in Sweden

[illegible]

Superpower Vindicated

[illegible]

Take Your Radio Along

How Auto Tourists Can Get Good Results with Simple Equipment

By JOHN CARR

YOU will find it worth while to carry along some kind of a radio receiving outfit on that auto camping trip you are planning. Aside from the entertainment, you will also tune-in much useful information, such as timely weather reports—always of interest to the camper—and special lectures and talks on auto camping equipment.

You can carry a radio receiver on your auto camping trip without adding appreciably to the luggage if you carefully study your own requirements and take along nothing unnecessary.

You must decide first whether you want an outfit that operates only with hand phones or one with a loudspeaker. Naturally, the hand phone set is simpler, less expensive and more compact than a loudspeaker set.

If you decide on hand phones, the most practical combination is a simple regenerative receiver fitted with one stage of audio amplification and built into a compact and strong carrying case.

Because of the short antenna you will be forced to use, you should increase the number of turns in the antenna coil of the tuning unit if it is of the standard three-core type consisting of an antenna coil, a secondary coil, and a rotating tickler coil. In most cases, the number of turns in the antenna coil should be increased from fifty to seventy-five percent.

You will not need an A-battery. The regular starting battery on the car will supply ample current for the filaments of the tubes of any type of set. This is true whether the set uses storage battery or dry cell tubes, for dry cell tubes work

nice on a six-volt storage battery if suitable resistance is added in the circuit.

To make a connection from the starting battery to the A-battery circuit, attach a length of electric light drop cord to the minus and plus A-bonding post of your set and fit a trouble light plug on the end of one wire and a spring battery clip on the other. Then when you want to operate the radio set, remove the dash light bulb, put the plug on the radio wire in its place, and snap the battery clip to the exposed metal of the steering wheel or dash. The tubes will light when you turn on the dash light switch.

This arrangement is correct for storage battery tubes on a car with the single wire six volt system. If you use dry cell tubes, add a fixed resistance to the circuit to balance the extra voltage. The value of this resistance will depend on the number and type of tubes in the set. Make sure that you have the positive bonding post on the set actually connected to the positive side of the starting battery.

You will need an antenna and a ground connection. For the antenna get about seventy-five feet of flexible insulated wire and attach to the end of a small antenna insulator. Then get about fifty feet of string. Tie one end to the insulator and attach the other end to a tree or



Any Car Provides A-Battery Power

Your starting battery connected to your set as shown here will supply current to operate the tubes. A portable antenna is attached easily to a tree. With hand phones, a two-tube set will give satisfactory results.

other end. The sucker can be tossed over the limb of a tree.

The ground connection is also easy. All you need is an iron rod, about three eighths of an inch in diameter and a couple of feet long, with one end pointed and a hole drilled in the other end for the fitting of a bonding post.

On rocky, dry ground, fair signals may be obtained without any ground connection at all. The automobile frame will act as a ground if the filament circuit is also connected to the ground wire.

DRY cell B-batteries of the small size will not take up much room in your tool kit or you may have or build a set in which space is provided for them.

For loudspeaker operation, you need a set having at least three tubes. Four tubes would be even better. Two of the tubes should be used in two stages of audio amplification, and the other two give one stage of radio frequency amplification and a regenerative detector. The filaments of the tubes can be run from the starting battery, but it will require at least ninety volts of dry cell B-batteries to operate the audio amplifier end.

A cone type loudspeaker or a large horn is seriously out of the question. The first is much too delicate to stand such treatment and the latter will take up too much room. The best combination is a strongly constructed phonograph unit fitted to a short metal horn.

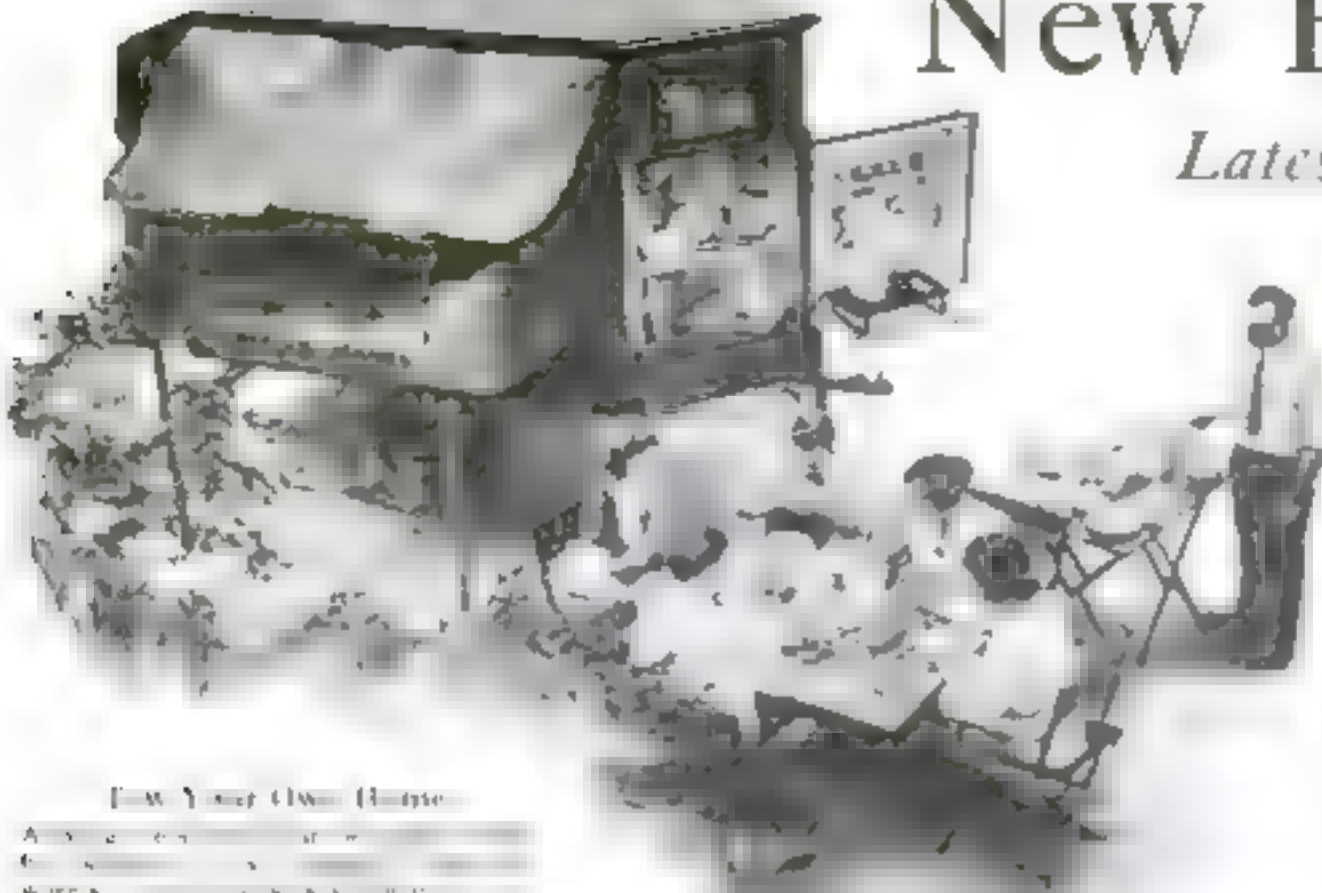
For the auto camper who can afford to spend more money, there are a number of very compact loop-operated sets available. They are built in cabinets with compartments for both A-batteries and B-batteries of the dry cell type, and with an outfit of this kind you do not need to bother about antenna equipment or other accessories.



Any good loop-operated set is excellent equipment for auto camping. Be sure the cabinet holds dry cell batteries and includes a built-in loudspeaker. Such outfits eliminate portable antenna and ground connections.

New Helps for

Latest Type of Equipment



Low-Yield One-Header

A new type of one-header...
...the...
...the...



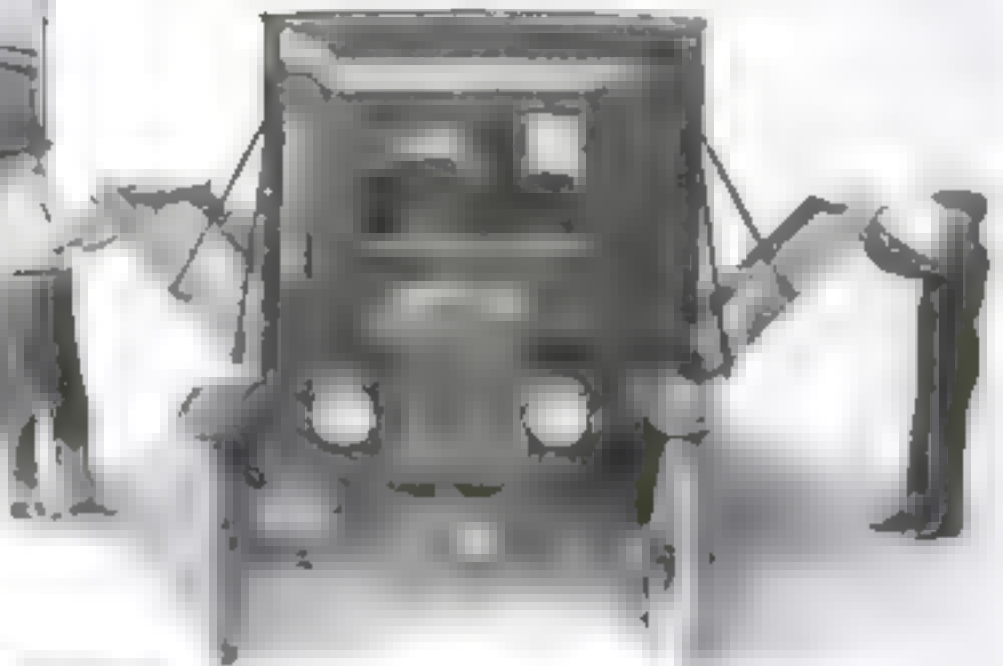
This One-Header... Loads Up

The...
...the...



A Pullman Berth in Your Sedan

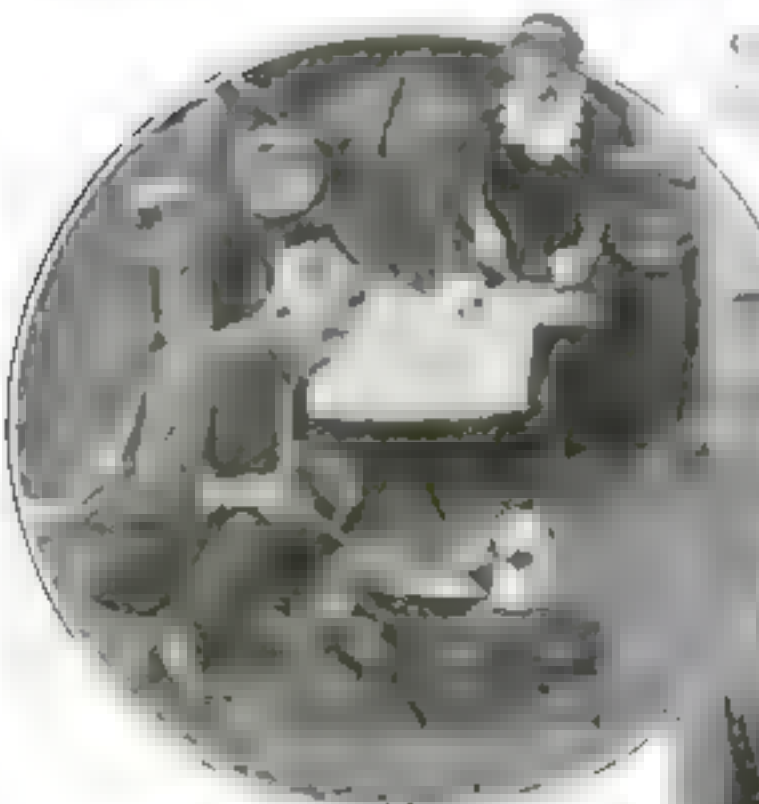
The...
...the...



Camp Stoves Cook Quickly



How CR... When Beds Are Opened



Tent Poles That Fold Up

The...
...the...



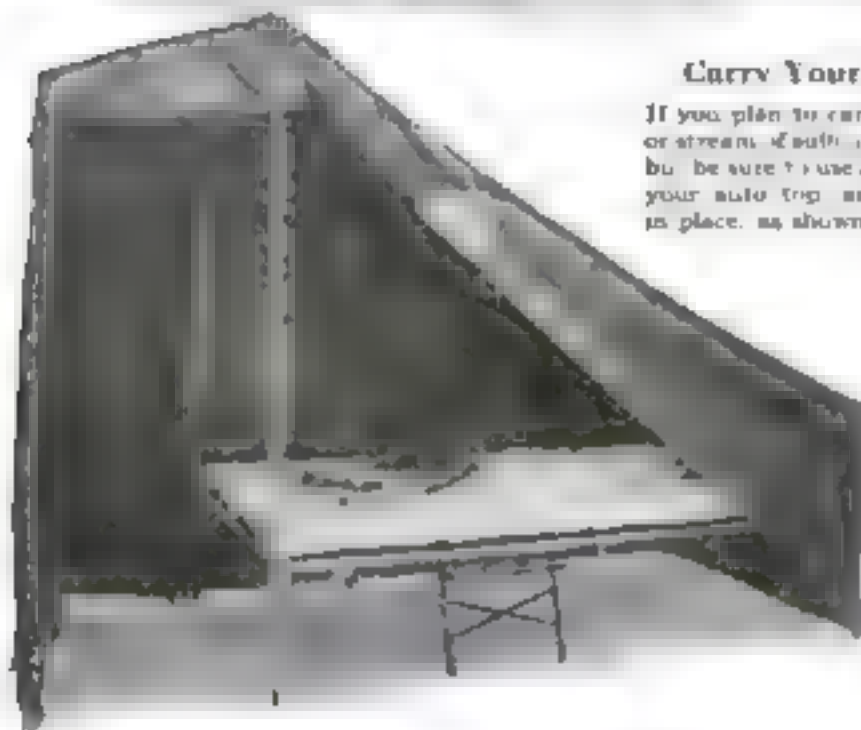
the Auto Camper

Can Be Packed in Small Space



Carry Your Canoe This Way

If you plan to camp on the shore of a lake or stream, it will be well to carry your canoe, but be sure to use ample padding to protect your auto trip and lash the canoe firmly in place, as shown in the illustration above.



Car Supports Tent

The tent at the left is one of many styles now on the market that are supported on one side by the camper's auto. By doing the number of poles to be cast out. Weight of car holds tent in place against sudden wind storms.

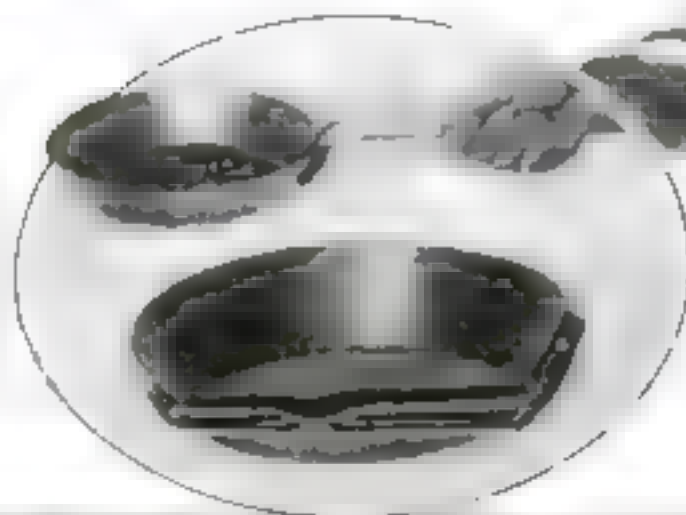


Fill Water Tank Quickly

This elaborate trailer is fitted with a suction pump that draws water directly from the well into the supply tank. Instead of pouring in pail after pail, a hose is used and power put on.

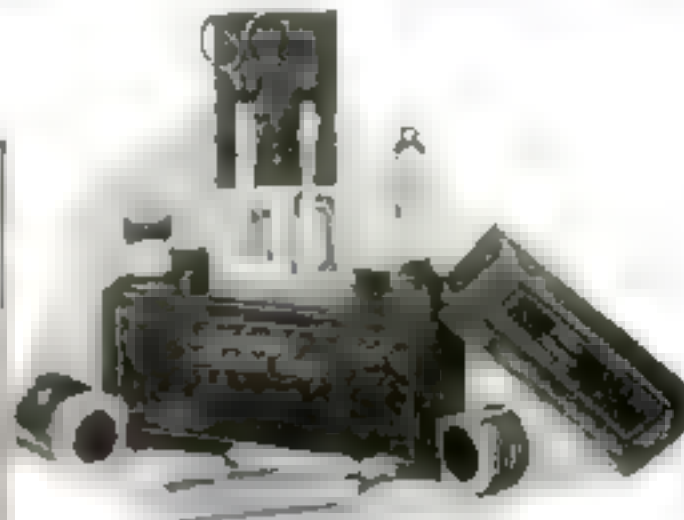
A Folding Frying Pan

The handle of the frying pan at the right is so arranged that it can be folded back against the bottom of the pan. This feature saves space and prevents the damage that is often caused by the handle digging into the tent of the equipment.



Sleep on Air for Comfort

This air-cushion mattress is said to be a worth while addition to the camper's outfit. When not inflated it takes up little room, and after a few minutes' work with a pump makes a comfortable bed.



Don't Forget First Aid Kit

Every auto camper should carry a first aid kit. Neglected cuts and scratches often develop into serious cases of blood poisoning, and safety first is a good motto for campers to avoid inconveniences.

Edison a Camping Enthusiast

This is the way (left) Thomas A. Edison carries his camping outfit. Every part of it is made to fit into a long case that occupies the entire running board of one side of the car. It contains everything that is needed for comfort, if not actual luxury.



Before You Go Auto Camping

"Now we'll show you a real tent," said Henry when dinner was over. And he led the way to the car parked back of the house. "Just watch, and see how quick we can get the tent up."

"Gosh!" exclaimed Joe admiringly. "You two are the original lightning change campers! couldn't have taken you ten minutes!"



Gus Says Look to Your Tires, Spark Plugs, Crankcase, and Save Trouble

By MARTIN BUNN

"HELLO, Uncle Gus. What do you know about auto camping?" called Gus Wilson's nephew, Henry, to the older man as he stepped inside and slammed the door of the Model Garage with a resounding crash.

"What do you want to know for?" growled the veteran auto mechanic. "Go easy on that door the next time! What's the big idea about auto camping? Are you and Grace fixing to take a full out of that game?"

"You guessed right the first time!" replied Henry. "That's just what we are going to do, and I want you to tell me how to get the car ready for the trip."

"Humph!" grunted Gus. "It all depends on where you are going, how long you expect to be on the road, and so forth. If it's just a matter of running about fifty miles or so to the nearest camp and staying there for your whole vacation, I don't see why you should need to make any special preparations except to see that the bus is filled up with gas, oil, and water."

"THAT'S not auto camping at all," Henry scoffed. "I mean the real thing—every night in a different place and lots of miles covered every day."

"Gosh!" exclaimed Gus. "You are a brute for punishment! All right, if that's the kind of a trip you want to make, there's a whole lot of things you ought to do to the car. Let's see—you've had it a bit more than a month now. How many miles have you driven?"

"Speedometer shows just over a thousand," replied Henry.

"Well," said Gus, "they say that the first hundred years are the hardest but as far as autos are concerned, the first thousand miles usually get a bus broken

or fairly well, and if anything is likely to work loose that's when it shows up. So I guess you're all right."

Before you do anything else, I'd suggest that you climb into a pair of overalls and go over the car with a fine tooth comb. Try a wrench on every blessed bolt and nut you can find and see that all of them are good and tight.

"And while you are going over the car, keep your eyes peeled for anything that seems queer or not just right. Note whether the gasoline pipe is fastened tight so that it can't chafe against the frame or some other part. When you get to the engine, watch particularly for loose hose connections and a wing that seems to be loosening up."

"How about putting some braces in to reinforce the frame?" suggested Henry.

"Why do that?" Gus countered. "Your car was designed to carry five people, and if only you and Grace are going on this expedition, you certainly won't need to carry over three or four hundred pounds of baggage, and that is no more weight than three more passengers. Forget about frame bracing—just take it a bit easy when you strike extra rough going."

"You ought to arrange a couple of extra tanks under the hood. One for

gasoline and the other for lubricating oil. The extra gas tank is only for emergency if you happen to run out, but the oil tank ought to be big enough to hold a good supply so that you won't have to depend on getting fresh oil at some crossroads store where they sell you almost anything in the way of bootleg lubricating oil."

By the way," Gus continued, "what kind of tools did they give you with the car?"

"Pretty rotten layout," Henry replied. "The screw driver might be all right only the handle turns on the handle. The wrench must be made out of cast-iron—one of the jaws cracked right off the first time I used it, and the rest of the stuff is no better. Even the oil can leaks something awful."

"THEN," advised Gus, "you had better go into the office and let Joe help you pick out a good kit of tools. We've got quite a stock. There's no use going auto camping without a tool kit that is meant for business, and while you are at it get a set of chains. You may run into a spell of muddy going where they will be mighty useful. And don't forget to include two or three spools of brass wire and a couple of large-sized rolls of tire tape. You may not need them on the car, but they'll come in handy for holding the camp equipment together when it gets smashed."

"Huh!" snorted Henry. "Nothing is going to get busted in my camp outfit. You forget how careful I am."

"Maybe so, son," said Gus, smiling. "But auto camping stuff like folding tents and folding stoves and what-not has to be made light, and if you don't find good use for" (Continued on page 134)

When You Go Camping—

Have you tightened up all the bolts and nuts?

Are the tires in good shape for a long trip?

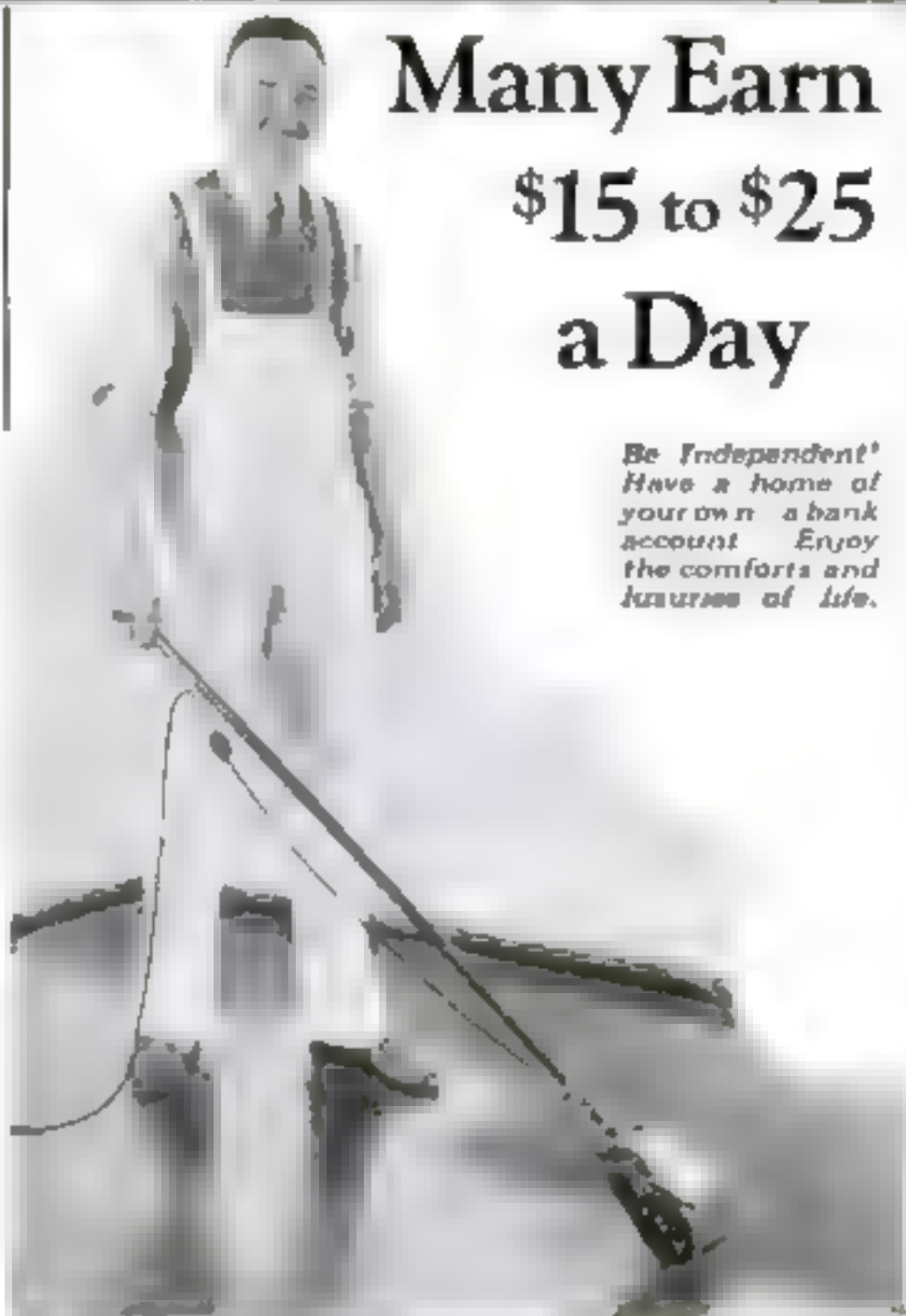
Has the crankcase been filled with fresh oil?

Is your tool kit complete with rolls of tape?

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Timely Aids for Car Owners

Seven Ingenious Ideas for Solving Common Problems

TWO blocks of wood, some short pieces of chain, and a few eyebolts will supply you with material to build yourself a sure cure for getting stuck in mudholes. As shown in Fig. 1, the wood blocks are cut as large as possible and yet clear the mud guards, and then the eyebolts are fitted at each corner. The chains can be fitted at one end with snap hooks. At each revolution of the rear wheels, the back of the car is raised up about eight inches and moved along about two feet, finally getting the car clear of the mud.

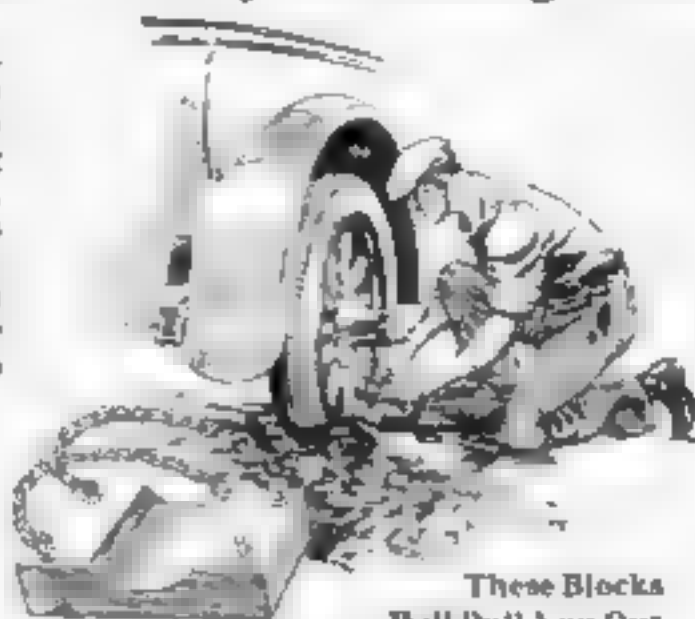


Fig. 1. Attaching wooden blocks with chains to rear wheels to aid in getting car out of a mudhole

ON PRACTICALLY all cars made today the ignition system operates on the closed circuit principle. This means that the contact points that are used to break the current in the primary circuit of the spark coil are closed except during a very brief interval following the break which causes the spark. And as the primary circuit of the standard type of spark coil has a relatively low resistance, it is necessary to put a special resistance coil in circuit with it to limit the flow of current. This special resistance coil is ordinarily located on the spark coil as shown in Fig. 2.



Fig. 2. How to start a car by a short circuit when a battery goes dead

When your battery unexpectedly goes dead—so dead that you cannot even start the car by hand cranking—you will find it possible to get the motor going by short-circuiting this resistance and thus permitting the greatest possible flow of current through the coil. A start can always be made in this way unless your battery is absolutely dead so that there is not the slightest amount of current left in it—a condition which is rare.

The method of short-circuiting this resistance coil will depend on the construction of the particular type of coil in your car but by a careful examination you will be able to see how to connect a short piece of wire so that the current can get around the resistance. The short-circuiting wire should be removed as soon as the motor has been started, because if it is left on for any length of time the extra current may seriously damage the coil.

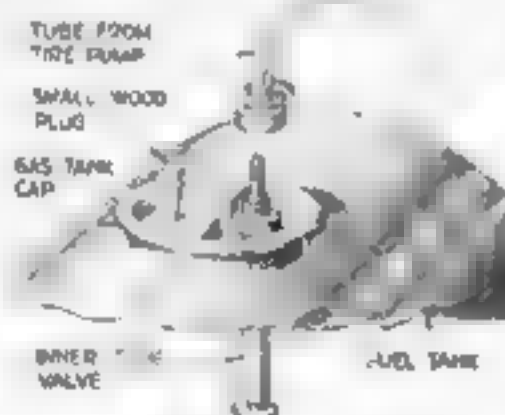


Fig. 4. Novel scheme keeps gas flowing to Ford carburetor on a steep hill



Fig. 3. Lock for gear shift and emergency brake. It is made of two pieces of flat steel

tank to get you over the top of the hill. Be careful not to pump too much air into the tank, as it is not built to stand high pressure, and it is apt to spring a leak that will cause serious trouble.

TWO pieces of flat steel, $\frac{3}{16}$ in. thick and $1\frac{1}{2}$ in. wide, can be filed as shown in Fig. 3, to form a satisfactory lock for the auto. It will have to be made to fit the gear shift and brake lever on your own car, of course. It can be locked with a small padlock.

EVERY motorist should carry along at least one spare tube when he is going on an extended trip, but there is no advantage in carrying a spare tube if it is simply thrown in the tool box and left there until needed. The constant chafing against the other tools will be sure to ruin it. The simplest possible container is a cake tin with a slot cut in the rim for the valve stem as illustrated in Fig. 5. It should be nailed securely to the bottom of the tool compartment so that it will stay in one place and not turn over and let the tube drop out.

IN THE higher-priced cars, great care is taken with the top construction to put the bows so that they will not wear through the top material, but this point is often neglected on low-priced cars. You can increase the life of the top on your car by padding the bows with old inner tubes folded and tacked in place, as shown in Fig. 6. Put in the tacks about an inch apart and be very careful to get the section of inner tube perfectly smooth, as even one wrinkle will cut through the top material in a short time.

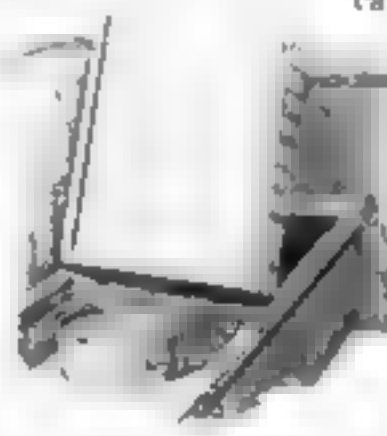


Fig. 5. A cake tin with slot for valve makes good tube container

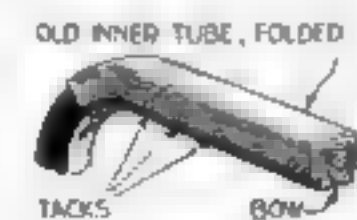


Fig. 6. Inner tube used to prevent bow cutting through top

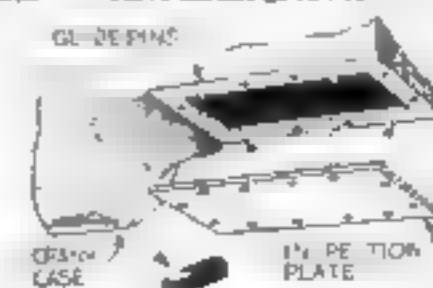


Fig. 7. This guide pin makes it easy to remove oil pan on Ford

Ten Dollars for an Idea!

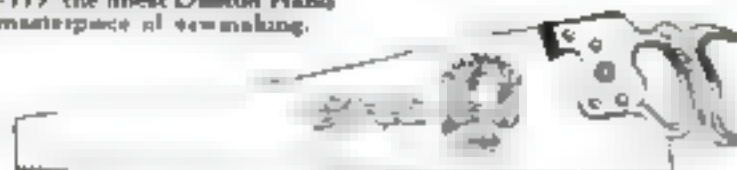
HARRY LINCÉ of Dearborn, Mich., wins the \$10 prize this month for the wooden tire blocks, Fig. 1. Each month **POPULAR SCIENCE MONTHLY** awards \$10 besides space rates for the best idea for motorists. Other published contributions will be paid for at usual rates.

EXCEPT in the case of the latest model Ford car, the gas tank on all Fords is so located that when less than two gallons remain in the tank the level is so low that no gas is supplied to the carburetor on very steep hills. An ordinary tire valve fitted in the gas tank cap with a wooden plug stuck in the air inlet hole as shown in Fig. 4, will allow you to pump enough air pressure into the

THE oil pan on the Ford is bolted to a steel ring that is splined into the lower section of the crankcase and as this ring is not fastened in place except by the bolts, it is rather a difficult matter to start the first two bolts, because the ring slips out of position so easily. Trouble along this line can be eliminated easily by making up a few studs consisting of bolts of the proper size with heads cut off and slotted for a screw driver. As shown in Fig. 7, the studs are screwed into the inside ring through the holes in the crankcase before an attempt is made to fit the oil pan. Then, when the oil pan is slipped into place, the studs hold the inner ring in one while the remaining bolts are screwed home. After that the special studs can be replaced with the regular bolts.



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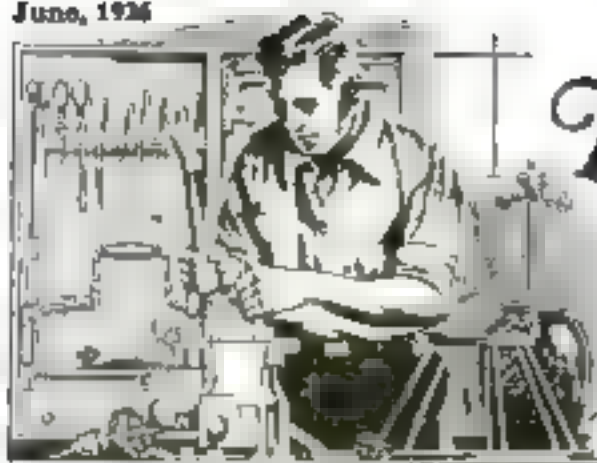


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The Home Workshop

Arthur Wakeling, Editor

My Workshop Gave Me a House

*I Made Most of the Furniture, Too, Though My Friends Had Laughed
When My First Table Fell Apart within Three Weeks*

By RUFUS E. DEERING

THREE years of spare time work as a Home Workshop enthusiast have given me a home and almost completely furnished it.

When first the urge to make things set me to sawing and planing at my roughly improvised bench, I think I had some hazy idea of building my own home sometime—and, perhaps, of furnishing it. I believed all workshop enthusiasts to be home builders. Some kind of an idea—a bit vague, but still clearly recognizable—was in my mind that the greatest achievement of any such enthusiast would be the building of his home.

My first attempt was the construction of a small table. The result was very amateurish; the table a failure. It fell to pieces and was used as kindling wood for less than three weeks. So abjectly and forlornly complete was the failure, that my attempt became one of the standing jokes in my family.

You home workshop addicts who have been over the road know how I felt about the failure of my table and the "kidding" I was getting. Once, when I was being playfully and, no doubt, justly ridiculed, I remarked that I intended to build a house myself, and not only do that, but furnish it as well.

Today we live in a modern five room home, which I built in spare time during the last two years. In addition, I have built twelve pieces of fine walnut furniture. These we use every day in our home.

MY ONLY help in the building of the house was a man to mix the plaster, one to help with the chimney, and a carpenter for a week when it was necessary to get the house enclosed before cold weather might come.

At times it was difficult, working alone, especially when the frame was being lifted, when the rafters were put in place, and then when the roof was shingled. The last was a tedious, never-ending job for one working single-handed. It was especially so for me, since I had to do it after my regular day's work was done.

Now that my house is finished, I know it will not fall down as the first table did. Last summer a tornado passed through our yard. A steel windmill eighty feet



Above: Mr. Deering working on a turned and twisted table leg which is now in use.



This is the house Mr. Deering built single-handed, in spare time, from materials he salvaged himself. The photo was taken before the house was entirely finished.

from our house was torn down and the 400-pound steel wheel landed within two feet of our front door. Trees in the yard were torn up, but the house didn't even shake, although two windows were broken by the force of the wind. I know, too, that our pieces of furniture will not fall apart, for we use them every day. So I am satisfied with my house.

I am not an idle man, nor one who has a great amount of leisure to devote to his workshop. I have my daily stint to do at my regular job, and it is usually nearer a ten hour day than eight. I just wanted a home and wanted it well furnished, so I found time outside of my regular working hours to do it.

We had an old two room house and a barn on our place. They were not fitted to our needs at all. However, they contained a great amount of good, sound lumber, which I could use in building our home.

OF ALL the work in building our new house, the most discouraging part was the wrecking of these old buildings. I was determined to do the wrecking without destroying a single piece of lumber if I could help it.

All the old shingles, which were sound as the beams, had been nailed in place, and were removed by driving the heads of the shingle nails through with a nailset. Prying old nails from the heavier pieces of lumber was a still more laborious and tedious task.

This preliminary wrecking proved so exhausting that my ambition to build a home came near having "died a-borning." Once the old buildings were down, though, things were different, for each step in building the new house was full of interest and thrills. Putting shingles on the roof by moonlight, lathing, laying floors, building frames by lamplight,

and constructing the inside part of the chimney by the dim yellow glow of an oil lamp, hard as some of these tasks were, they could not approach the heart-breaking experiences of the previous process.

I made errors, of course—the errors of a beginner—but corrected them as I went along. Some of the errors were laughable, some tragic. One (Continued on page 90)

How to Make Woodwork Look New

It's Merely a Matter of Knowing the Right Way of Applying Varnish and Enamel

B. RALPH G. WARING

Specialist in Auto and Furniture Finishes

After the enamel has been smoothed with sandpaper, as pictured below, a full coat of enamel is brushed on, as shown at left.

the window sills for the new enamel. It never pays to lay new enamel over the old checked foundation, for the same reason that a house cannot be built safely on sand.

By using varnish remover, No. 2 steel wool, and a putty knife, all the old finish was quickly taken down to the wood, which was then washed with denatured alcohol and sanded smooth.

We used an old varnish brush to apply good floor varnish—the safest priming for enamels. The next day the varnished sills could be sanded and given a coat of white, made from half part undercoater and half part enamel.

WINDOW sills require tougher and more flexible coatings than other woodwork, owing to exposure to sun and rain. The undercoater is usually hard and brittle, while enamel is quite flexible. Two or three coats would have to be applied and about two days allowed for each to dry, after which they would be sanded lightly until smooth. The last coat used would be either the full gloss or the egg-shell enamel (we preferred the latter) just as it came from the can.

When the time came to enamel the door and fireplace with its mantel and moldings, I explained to Dan that enamel is much different in its brushing properties from shellac, varnish or paint. It has but little covering capacity or ability to hide undersurfaces, and hence fresh undercoatings are often necessary. It is much stiffer to brush, and, therefore, has to be applied in a warm room. If not handled properly, it will show brush marks and laps.

In the case of the door, the inside face was flat with

(Continued on page 80)

HOW DARE I ask you to do some of the inside work of the house?

"Fear" said Dan. "Mother has a new coat of paint on the walls and I'd have to match some old and new work. I don't know even how to go about it."

At right, it won't take long for you to learn. We stop at the paint store and get our supplies.

We shall need a quart of enamel undercoater, a quart of egg-shell enamel, a dozen sheets of Number 00 "wet or dry" sandpaper, a quarter pound of Number Two steel wool, two pounds of whiting, and a pound of white lead. Also, a two-inch full chisel fitch brush, a half pint of orange shellac, and a pint of alcohol, finally, a quart of egg shell varnish and a quart of turpentine. Some of our work is new, so we'll need about three pounds of natural paste wood filler and a half pound each of raw sawing and burnt umber.

When we got to the house, we laid drop cloths on the floor by the front door. Then I had Dan make a putty from one third white lead paste and two thirds dry whiting, with a few drops of varnish, all worked in the hand to a rather stiff dough. This kind of putty dries rock hard without shrinking, can be sanded smoothly, and would not squeeze out of the joint if the panels should swell a bit during the summer. Common store putty would dry too slowly and be too soft for our purpose.

Dan forced the putty into the joints with his thumb, working against the part already filled in order to pack the putty in solid. Then it was leveled off with a flexible putty knife.

This putty, it should be said paren-

thetically, was allowed to dry for two days and then water-sanded smooth and level.

When the puttying had been done, we moved the cloths over to the fireplace. We tore our Number 00 wet or dry sandpaper into eighth sheets, dipped them into the water pail, and quickly cut down the old enamel until clean and level. I explained that this new paper, although a bit more expensive than the usual flint paper, was quite economical in that it did the work quickly, without much "elbow grease," and with no dust to affect the lungs and stomach.

When everything was rubbed level and smooth, I had Dan wash the woodwork with a grass sponge dry with a chainas, and then leave for a while to be sure any remaining moisture had disappeared. Then he puttied up a few little holes and other defects.

While the fireplace and mantel were drying, I showed Dan how to scrape



Dan fills the library panel work with paste wood filler. Before it hardens, the filler is wiped off across the grain.

The Home Workshop

How to Wire an Electric Bracket Fixture

By GEORGE A. WILLOUGHBY

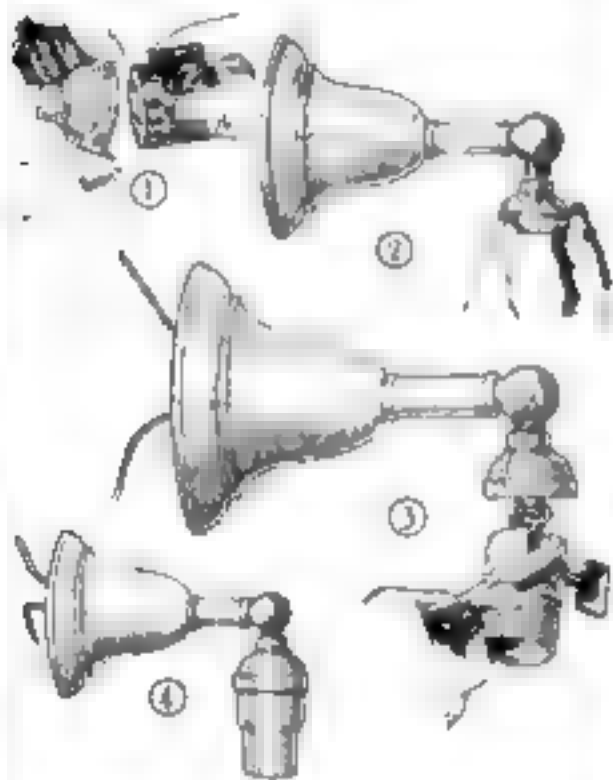
Superintendent of Electric Work, Arthur Hill
Trade School, Saginaw, Mich.

HOME workers find it necessary from time to time to wire an electric fixture or lamp. Perhaps a bracket will become loose or disconnected, or the fixture will "blow a fuse" because the wires in it have been twisted until they are broken and touch each other or the metal of the fixture.

It may be desirable also, to replace an old fixture with a new one. Or you may construct a lamp and wish to wire it in accordance with the best practice.

The following instructions refer especially to the wiring of a bracket, but they also apply to the wiring of any similar device.

Obtain a sufficient amount of fixture wire, double it, push it through the fixture,



Take the socket apart: 1, screw cap on fixture; 2, connect wires; 3, and reassemble; 4

and then cut it in two. If this cannot be done, push a stiff wire through the fixture first and pull the fixture wire with it. Be careful; the wires are not stranded, twisted or broken.

The diagrams show graphically the necessary steps. 1) Assemble the socket to be used on the fixture (Fig. 1) by applying pressure with the thumb at the point marked "press." Screw the cap of the socket (Fig. 2) onto the small threaded part of the fixture. Push or pull the fixture wire through the fixture and allow for connecting the socket at one end and the feed wires at the other end.

Tie an Underwriters' knot in the fixture wire, carefully remove the covering from the required amount of wire at the ends, twist the strands of each end together, turn them once around the binding screws, and cut off the excess wire (Fig. 3). Be sure that uncovered wires cannot touch each other. The wired fixture ready for connecting to the feed wires is shown in Fig. 4.

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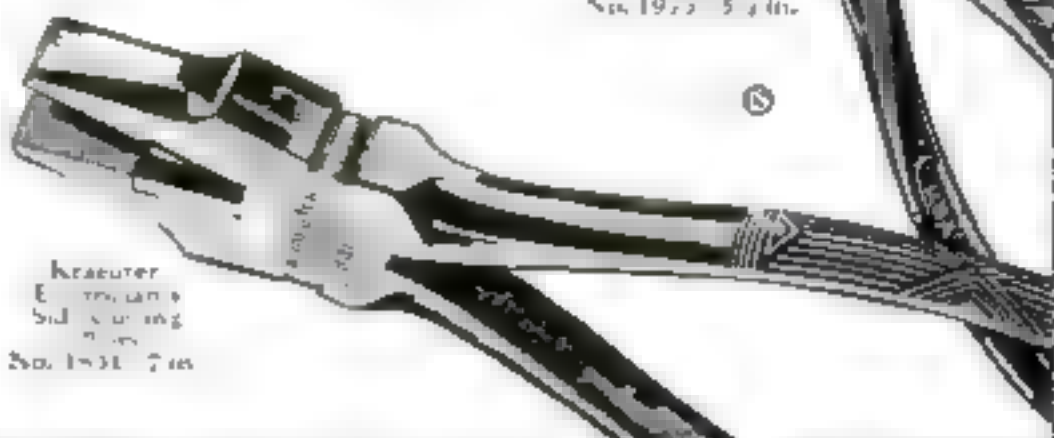
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A Ship Model Anyone Can Build

Materials for Simplified Spanish Galleon Cost \$5

By CAPTAIN E. ARMITAGE MCCANN

WE COME now to the pleasant work of embellishing the hull of our Spanish galleon ship model with its small fittings, and raising the billowing spread of gaily painted canvas.

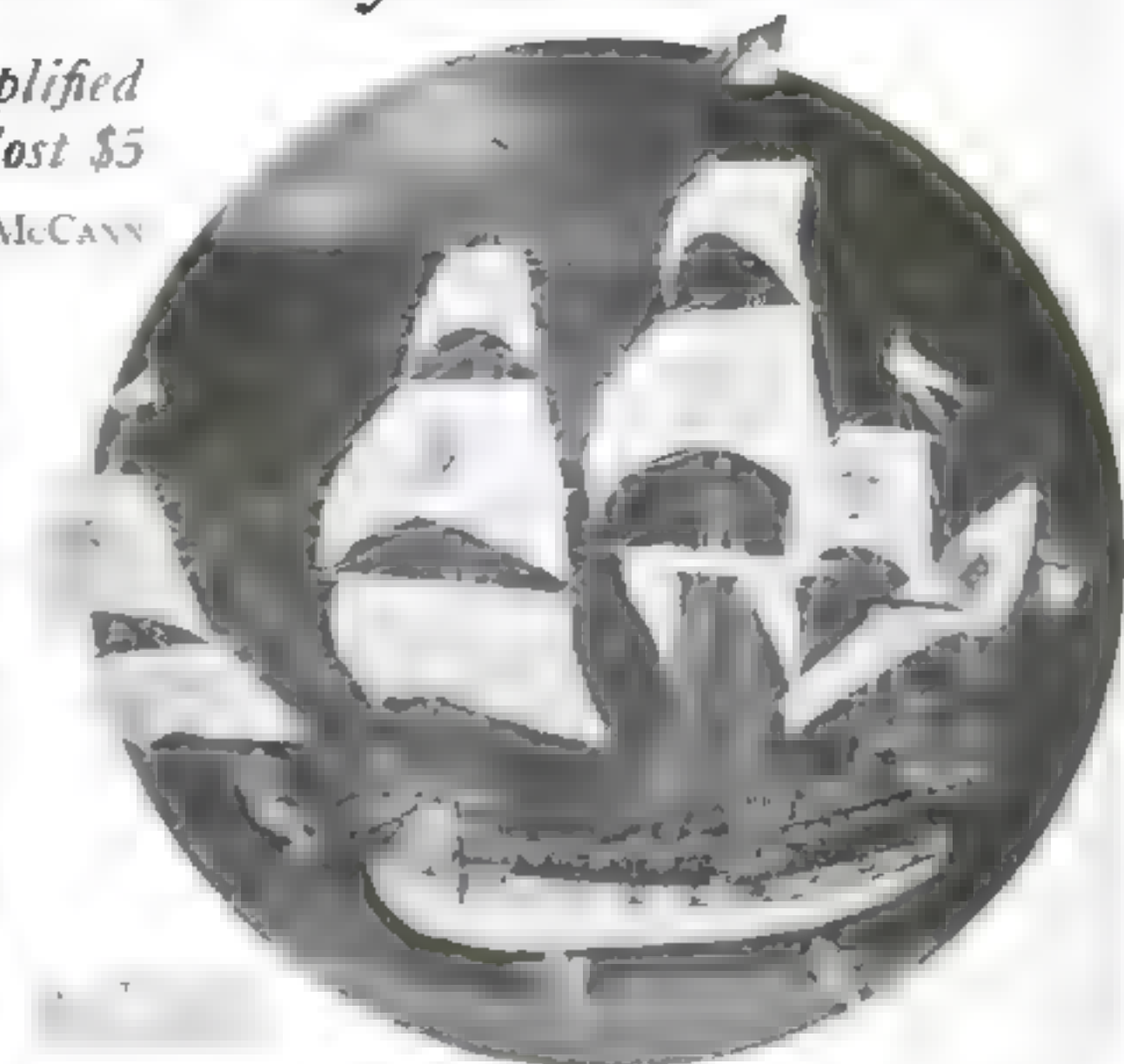
If by any chance you missed last month's article, in which the construction of the hull was described, you can obtain a copy of the May issue from POPULAR SCIENCE MONTHLY's circulation department or send for blueprints that give the necessary information (see page 83).

Two anchors (A, Fig. 7) are needed. The shanks and arms of these may be cast in bronze, cut from lead pipe, whittled from wood, or bought ready-made. The shanks should be about 2 in. long. The stocks are about the same length as the shanks, they are wood with a hole bored to take the shank. The rings are wire. Stain the stocks brown and paint on black rings to represent the cambring bands. The remainder should be a green-bronze color.

The guns are cut from small wooden dowel sticks. Those for the main deck are $\frac{3}{4}$ in. in diameter and 1 in. long, shaped as shown at B, Fig. 7 with a small lead pin driven in the forward end. The carriages C are $\frac{3}{4}$ in. long, cut with a fretsaw from a square stick of soft wood $\frac{3}{4}$ in. square. They are painted black, and all the guns are antique bronze.

The orlop (lower) deck guns are similar but the forward ends are not finished off. Four of the upper deck guns are longer so that their hulls can be glued against the center piece.

The main guns are about 1 in. in diameter; a piece of copper wire is passed



In constructing this model it will save you much time if you use Meier Workshop Blueprints Nos. 46 and 47 which you may obtain for twenty-five cents each from the Blueprint Service Department of Popular Science Monthly, 250 Fourth Avenue New York City. See page 93.

through a hole in each of them and brought together underneath and twisted to form a swivel stand. There might also be two long thin guns on the forecabin; and two should project from the stern gallery.

The wrenth openings and the gun ports are

made of thin tough cardboard. The outside diameter of the circle is $\frac{1}{2}$ in.; in the center, three $\frac{1}{4}$ in. cuts are made and the square center flap is bent up, to represent the port. The rim is gilded and the port painted scarlet on both sides. These are glued over each opening.

Paint all these parts and lay them aside for the present.

For the rigging of the ship, a few additional tools will be handy—a pair of good embroidery scissors, tweezers, and some needles (No. 7 crewel are best).

You will also want some good cord, such as fishing line—some about as thick as 12 sheets of this magazine; some about half that, for the rigging; and some bead or purse twist of luster cotton or silk of a rich brown color (it can be dyed if necessary).

The masts and yards are made from dowel sticks, $\frac{3}{4}$ and $\frac{1}{2}$ in. in diameter. These are round birch rods, ordinarily 5 ft. long, which can be obtained at almost any hardware store. The lengths are given in the rigging detail, Fig. 5. The mainmast is $\frac{3}{4}$ in. at the step (bottom), tapering to the top (see Fig. 4); the topmast is slightly thinner, and the topgallant mast still thinner. The foremast is a little smaller than the main, and the mizzenmast than the fore.

The bowsprit tapers from $\frac{3}{4}$ to $\frac{1}{2}$ in. Cut the end of the bowsprit $\frac{1}{2}$ in. square, and for the sprit-topmast take a piece of the $\frac{3}{4}$ in. dowel and cut a hole to fit the bowsprit end at a slant. When the bowsprit is in

(Continued on page 84)

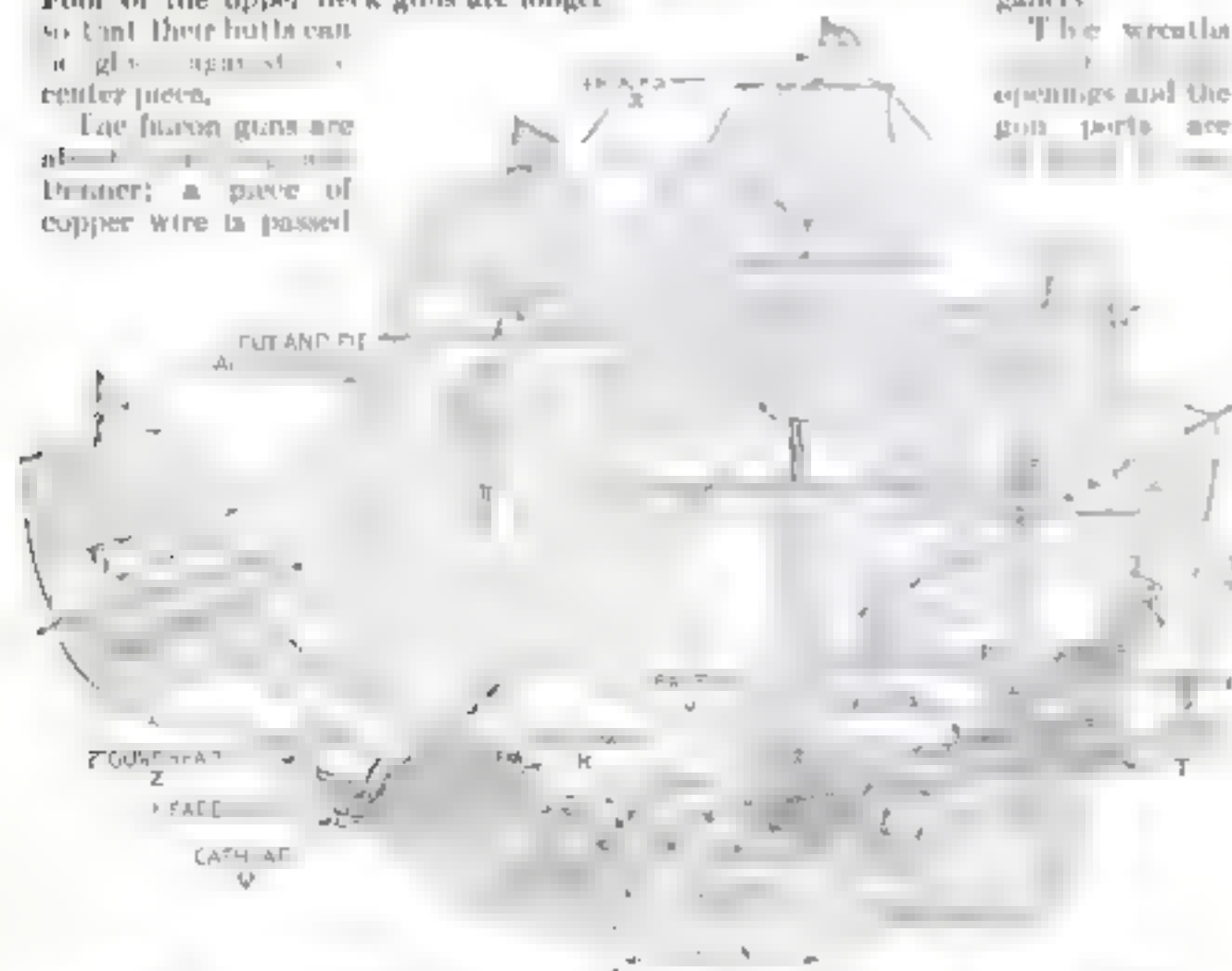


Fig. 2. A convenient view to illustrate the general arrangement of the rigging and sails, and to indicate the coloring of the hull. Compare with the rigging plan in Fig. 5 on page 82.

Combining a Laundry Yard with a Grape Arbor

By C. L. MELLER

IN THE small yard, where space is at a premium and where it is especially essential that every effort be made to combine beauty and utility, the clothes posts can be put up to form an attractive grape arbor.

The one illustrated was built of eight 4 by 4 in. uprights set 3 ft. in the ground and extending 7 ft. above. The area occupied is about 20 by 12 ft. over all. With four posts at either end, the effect is that of three open panels at both front and rear.

The middle panel with its arch and fan effect is 4 ft. 6 in. wide from center to center of the posts, while the panel to either side measures 2 ft. 6 in. from center to center of the posts.

For the arches, 1-in. material was used, the pieces being laid together so as to break the grain. The fan-shaped effect was produced by mortising thin strips properly spaced into the under side of the arches and bolting these solidly together



When embellished in this way, a laundry yard does not detract from the neatness of the garden.

at the lower end. To keep the strips equidistant from each other, two short lengths of the same material were tacked across them, spaced as shown. The bottom end of the fan was bolted to a length of "two by four" set in the ground.

Caps 2 in. thick and 6 in. square, with the lower end beveled, surmount the posts. Four by four inch stringers rest upon these caps, and the ends of the arches are supported upon these stringers.

To provide places to which to screw the hooks for the lines, short lengths of "two by four" connect the posts of each outer panel about 3 1/2 ft. from the ground. The narrower uprights spaced between these lower "two by fours" and the stringers are pieces of 2 by 2 in. lumber, as are also the short crosspieces on top of the stringers, which will serve in time as an additional support for the grapes now.

The secret of a good job lies in being sure of all your measurements before cutting up the lumber.

Three coats of paint are better than two. Perhaps the best effect results when the color matches the trim of the house or garage near which the arbor is erected.

Turn to page 78 for the continuation of the Home Workshop Department.

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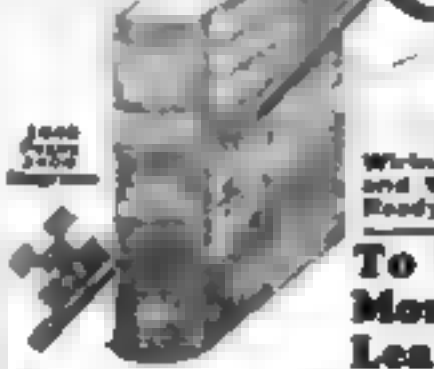


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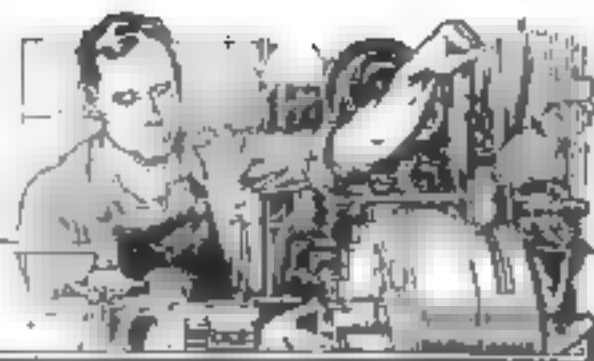
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Better Shop Methods

How Expert Mechanics Save Time and Labor



Ways to Hurry Up That Milling Job

The Right Speeds and Feeds to Use—Figuring Them by Simple, Short-Cut Methods

cool off. On account of this cooling effect, it is often possible to use speeds for milling that are from ten to twenty percent faster than for turning or boring.

When you speak of speeds in milling, Harvey asked, "don't you mean the number of revolutions per minute the cutter makes?"

"That's the idea exactly," replied Grimes. "You figure the cutter speed the same as if figuring turning or boring, as I told you the

last time you were here."

The formulas are:

C = Cutting speed in feet per minute
D = Diameter of cutter
R = Revolutions per minute

Then

$$R = \frac{C \times 12}{D}$$

and

$$C = \frac{R \times D}{12}$$

"All right," said Harvey. "I've got that all down in my notebook."

"Now," continued Grimes, "take the first job of yours (shown at A, Fig. 1). You've got to cut a keyway three quarters of an inch wide through the shaft shown. The keyway is three eighths of an inch deep and the length of cut is seventeen and one quarter inches. The question is, what feeds and speeds can we use and

how long will it take, using high speed cutters? Let's see what we have to think of first. Put it down in your book, Harvey."

This is what Harvey wrote.

A. Kind of material

B. Accuracy required. In this instance, a roughing cut, limits of from .750

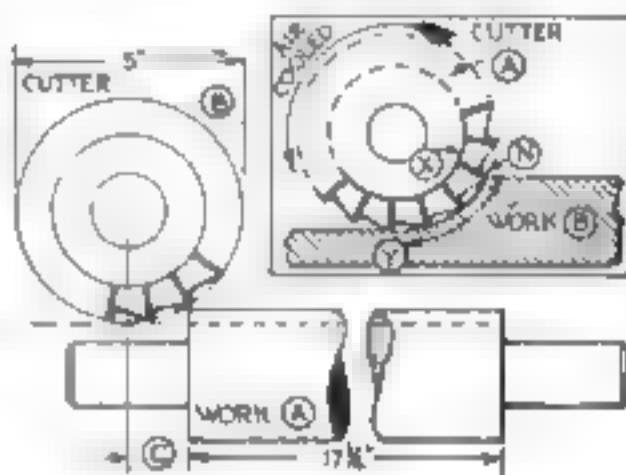


Fig. 2. Upper diagram. Milling cutter at work. Fig. 3 (Lower). Figuring table travel.

to .752, to be handled in one cut without trouble.

C. Method of holding. Two pieces at a time side by side in a fixture, very solid and rigid. If a very solid, heavy fixture is used with good clamps, it is possible to cut much faster than if a light fixture and clamps are used.

D. Lubrication of cutters. There must be plenty of oil flowing down over the cutters to cool them and lubricate the work.

E. Type of machine used. This is important because power and rigidity are needed for a job of this kind.

F. Arbor support. In any kind of milling, the support for the arbor should be as close to the cutters as possible to prevent springing.

"Now we've got it all, I guess, Harvey."

"Well, I hope so," laughed Harvey. "Do I have to think of all this every time I do a job? I'm afraid I'll get brain lag!"

"Don't get impatient! The material is cold rolled steel, we can cut this at eighty or ninety feet per minute, with a normal feed."

"But how do I know what a normal feed is?"

(Continued on page 102)

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, which you will find on pages 100 to 109.

By ALBERT A. DOWD

Consulting Engineer

"I'VE been transferred to the milling department again, Mr. Grimes," remarked Harvey one morning to the efficiency engineer. "and I'd like to come up to your house again for some more dope on feeds and speeds. There are several jobs coming along that I want to be sure to start right."

"Come up tonight, if you like," Grimes responded heartily. "I'll be home all the evening. But while I'm here, let me see two or three of the jobs you have in mind."

"Here's a good one right here,"—and Harvey pointed to a number of work boxes containing steel shafts (A, Fig. 1). "I've got fifteen hundred of those shafts to mill a three quarter inch spline cut in. After that I shall have to mill those brass bars over there (B, Fig. 1) and probably those cast-iron cover plates (C, Fig. 1)."

"Those will do very well, Harvey," said Grimes. "I'll take a look at the fixtures you will have to use and get blueprints of the pieces, so I'll be all ready for you when you come up."

Promptly at 7:30 that evening Harvey appeared, notebook in pocket, all ready for business.

"NOW," said Grimes, plunging into the subject directly, "you must always bear in mind that while the teeth of a milling cutter are at work each tooth is being air cooled for a good part of the time in each revolution. Look at this sketch (Fig. 2). The cutter A is milling across the work B. Then any tooth, as X, only cuts from Y to N, the rest of the revolution is through the air, allowing it to

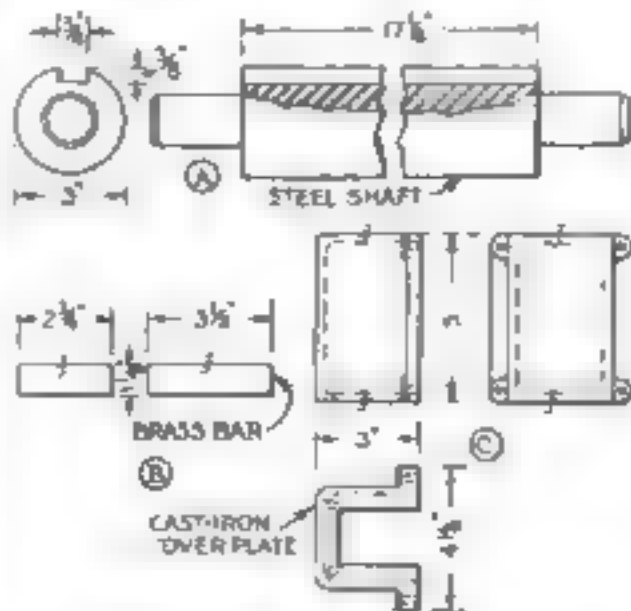
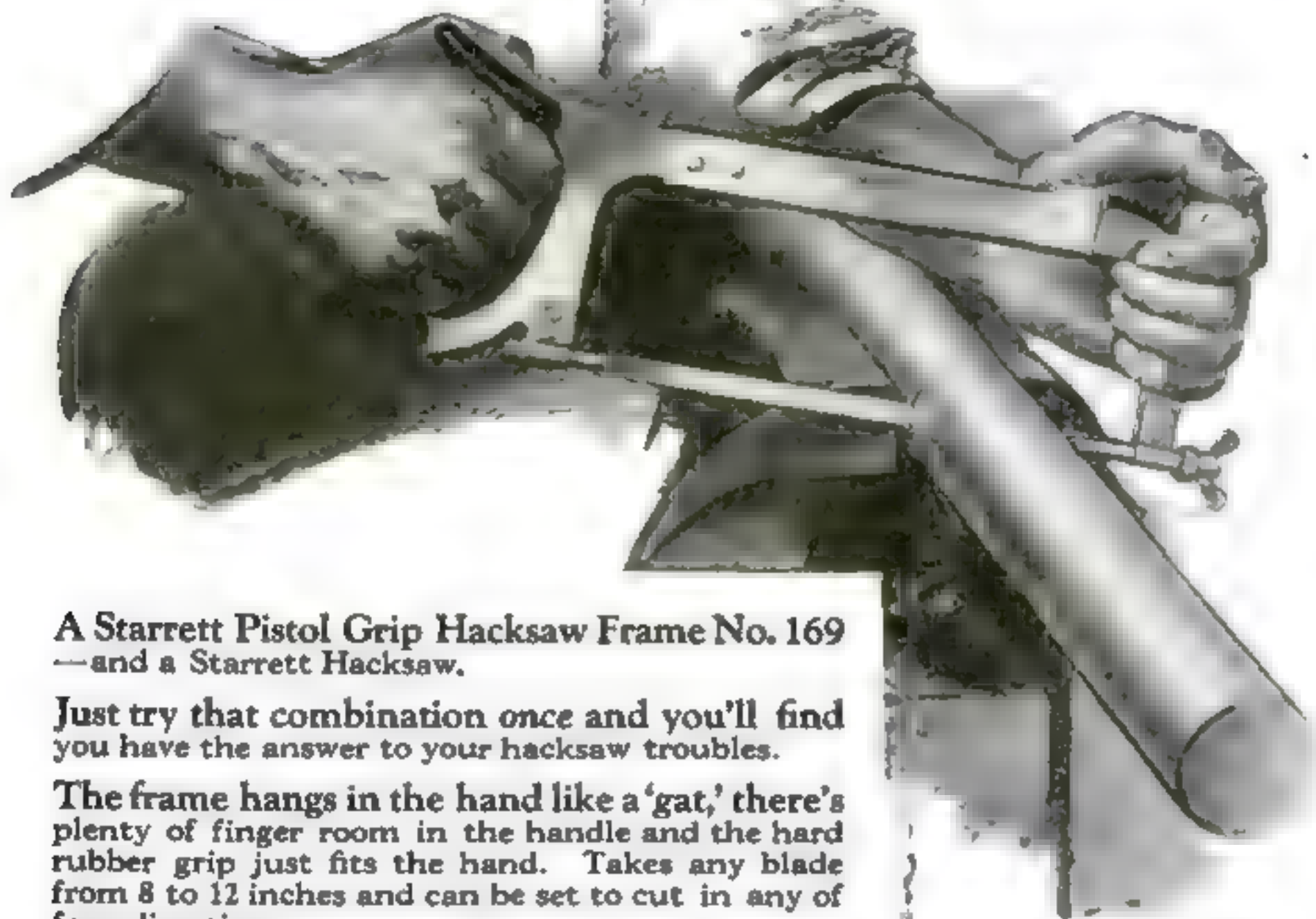


Fig. 1. Harvey's jobs involved cutting keyways, facing bars, and finishing cover plates.

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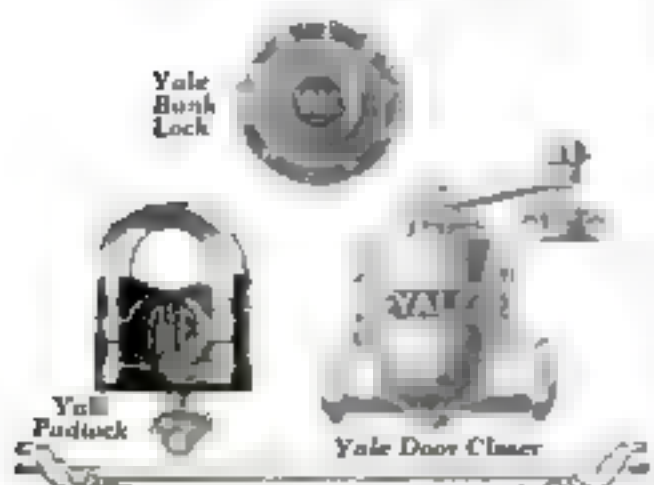
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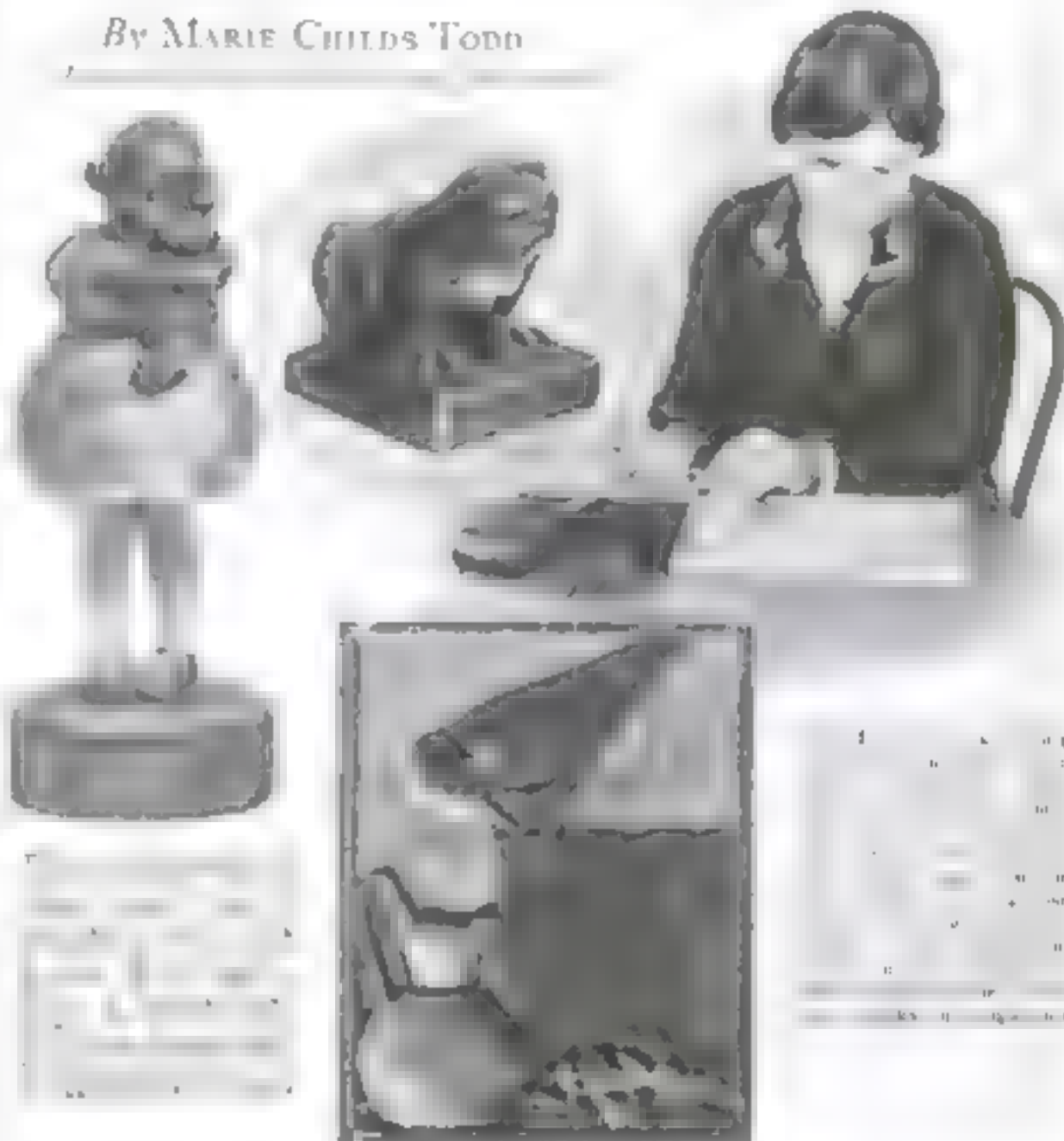


The Home Workshop

Simple Pocketknife Carving

How to Make Attractive Panels for Furniture and Ornaments for Home Decoration

By MARIE CHILDS TODD



WE USUALLY fight shy of wood carving because we feel that it is too difficult and tedious. I shall tell you a story of a fifteen-year-old girl and of a boy a few years older who made some useful and beautiful articles in wood carving with little aid of tools besides their own sharp pocketknives.

The boy felt a natural inward urge to decorate his own room. He set about carving a panel with historic Viking ships for his design idea. He used, for reference, Chatterton's book, "Sailing Ships" which gives some good black and white drawings to copy. He wanted this panel for the front of a gunwood treasure chest, which he was making for his room.

The work was so admired for its strength and simplicity of design that he was asked to sell his chest. Thus he would not do, but he took an order for another on which he is now working.

A young girl I know heard her mother express a wish for carved wood book ends or "book racks" as they sometimes are called. She used a Norwegian ship in full sail on a rough sea for her design. The photograph of this pair of book ends is reproduced on page 80. She used only

a Sloyd knife, a pocketknife, and one small V-shaped carving chisel. The work was stained brown, then vermillion red (or orange red), and blue-green oil paints (tube colors) were rubbed into the wood after the stain dried. Last of all, after the stain and color had set overnight, she waxed her work with a cloth and brush. She had completed and sold a second pair the week after her first pair was finished.

A panel with "Three Bears in the Wood" used as a motif was made by a sixteen-year-old girl, who had previously made only one other small panel. This panel was designed for a small door to a child's bookcase. Yellow poplar was the wood used. Two 4-in. clamps held her panel to the table while she was working. She used a pocketknife, a straight chisel, and a V-shaped chisel.

Wood is such a clear, refreshing material to handle, and it seems to carry with it a breath of the forests and to sing a song of life in the open. Only a small amount of material is necessary to begin this fascinating craft at home.

The best woods to use at first are gumwood, yellow poplar, or mahogany. Many workers will turn (Continued on page 79)

The Home Workshop

Simple Pocketknife Carving

(Continued from page 78)

naturally to basswood or common pine first, but these woods split too easily for durable work. California sugar pine and linden wood, however, are good. Wood should be ordered planed and kiln-dried and free as possible from all knots or rough places. Usually it is not desirable to have the grain show in pieces chosen for panels or wood sculpture.

The paper weights with the frog and turtle motifs (illustrated) were carved from yellow poplar. A magazine knife with a bird design for the handle and an envelope knife opener with a dog's head for a handle were carved from gumwood, also an umbrella handle from the same wood.

Freehand drawing of an original design is outline and the right proportions for the practical object to be made or decorated are desirable. Yet many could not do wood carving if freehand drawing and original design were essential. Fortunately it is a simple matter to find good designs for tracing or copying.

MANY historic architectural designs may be obtained from your library or art museum. The work is more interesting if applied to some simple, useful objects. A panel of wood that may be used for a box cover or small smoker's cabinet, door of a good thing to begin upon. Panels for chairs, for beds or bedside tables and for over-mantel decoration may be carved.

Much of the charm of some of the old wood carving lies in its crudeness, and this quality brings it within the power of the beginner to reproduce. A collector of antiques not long ago was looking about to find an amateur who would reproduce for him the missing part of an old piece, knowing that a professional could not give the naive treatment required.

Let the first design be in low relief on a panel, such as the "Three Bears" motif from a child's book. It is best to make the drawing in full size on paper and then transfer it to the wood by means of carbon paper.

A rather deep line is scored or cut with the knife around the entire design. This is done to protect part of the design from splitting off when a lateral pressure is used to lower the background.

THE first outline cutting on a panel with the point of the pocketknife should be to a depth of $\frac{1}{4}$ to $\frac{1}{2}$ in. according to the depth of the background desired. Though the background may be taken out with a sharp pocketknife very successfully, rapidly in work is obtained by using, besides the knife, a small straight, $\frac{1}{4}$ -in. wood chisel and a small mallet.

In a girls' camp in Oregon last summer, I saw very good wood-carved panels for box tops and chests made of California sugar pine, and done with a knife only. Very small, thin pieces of wood are cut away first so that (Continued on page 80)

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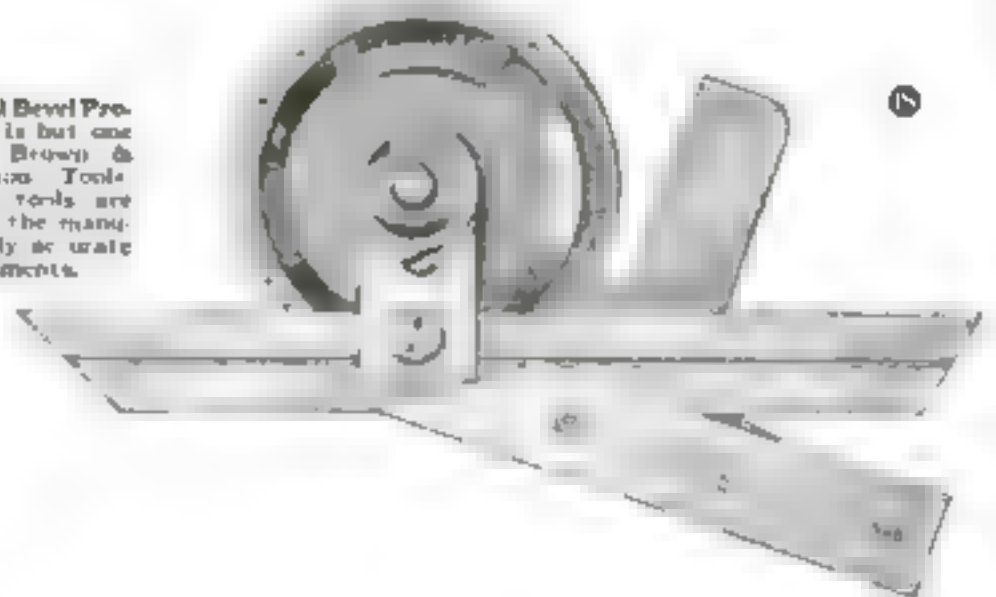


Place your eye at the end of a modern telescope and bring almost within your grasp the myriad worlds lying millions of miles away in space. But, for Science to advance still further into the realms of the Unknown, —instruments must be made even more carefully than the most powerful telescope of today, and these instruments of the future will be built by good tools —Tools of Brown & Sharpe Quality.

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Of course, to most people an empty tobacco tin is just something to throw away. But there are exceptions.

A railroad fireman started a pile of Edgeworth tins on the Atchafalaya desert as a sort of shrine, he says. Passengers and employees, according to his story, caught the spirit and the pile grew fast.

Another smoker writes from Egypt that he has scattered Edgeworth tins along the Nile and succeeded in placing one in the innermost chamber of a Pharaoh's tomb.

A telegraph operator says he uses Edgeworth tins as ampoules for the Morse code that comes in over his various wires.

Still another use is brought to light by Mr. L. C. Quinn of New York. He says

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Yours very truly,
L. C. Quinn



To those who have never tried Edgeworth we make this offer:

Let us send you free samples of Edgeworth so that you may test the pipe test if you like the samples, send back the tin and we will send you a tin of Edgeworth when you buy it, for it never changes in quality.

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[On your radio—tune in on WFLA, Richmond, Va., the Edgeworth station, Wave length 236 meters.]

The Home Workshop

Simple Pocketknife Carving

(Continued from page 77)

the knife blade may not be broken. Tooling your background lower nearest the raised design and a trifle higher toward the border edges gives the effect of higher relief for the center of interest in the design chosen. No sharp edges should be left in the raised design pattern.

Keep your tools sharp, and use an oil-stone and oil. After your first panel is completed, be sure to wipe off all waste particles of wood before applying a good wood stain. For this use a camel's-hair or ox-hair brush.

A brown walnut stain is good and may be dark or light, depending upon whether it is tanned. Let this dry several hours, then rub in a little wax in enamel or oil paints, rubbing this off partly. When this dries until the next day, wax the carving as one would a piece of wax-finished furniture.

The greater portion of the design always should show the knife strokes, in order to produce the most artistic effect. Never sandpaper if you can possibly avoid it. If a little sandpapering is neces-



What can be accomplished by the beginner is illustrated by this turtle paper weight.

sary, the finest quality should be used and only after you are through with knife work.

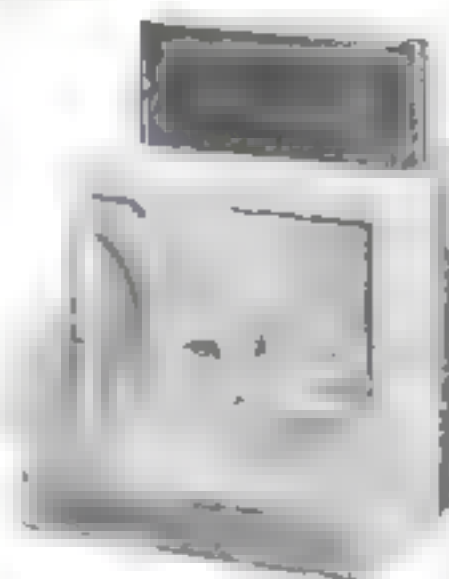
Colors that give good effects with the mellow brown tones in wood stains are emerald green, red-orange or Chinese vermilion, and red-violet. Any good hard-wood floor wax may be used and rubbed gently into the surface with a brush similar to the ordinary finger nail brush.

For the figures in wood sculpture small strips of lumber 3 by 3 in. in thickness and any length may be used. Always work in limitations of the raw material. That means, plan your design drawing for the width and thickness of the piece of wood you intend to use. The wood-sculptured figure pictured on page 78 is about 7 in. high.

We now take a step in advance of carving the panel. We carve in more than two dimensions in order to express human or animal forms in the round.

The drawing usually is placed on the strip of wood and marked with a pencil as to length first. Then a block may be sawed off about one eighth of an inch longer than the desired figure. At least three views of the design should be drawn, unless the carver is so gifted with a vision of things in the "round" that he can carve without drawing.

A small coping saw is used to saw



The young girl who carved these book ends made and sold a second pair within a week.

away all surplus corners of the block, but as you approach the form to be carved from the center of the block you must work carefully with the pocketknife or sloyd knife.

The base or pedestal is a separate piece, attached to the form carved.

Nature suggests the various shapes of knife strokes for representing textures of all kinds, such as the bark of a tree, the roundness of a clunk on a human figure, the fur on an animal, or the beauty of tree growths such as pine cones. Always work as much as possible in the direction of the grain of the wood.

If the amateur carver is not skilled enough to carve the features of the face, he need not be daunted, because after a good oval shape for the head is obtained he may paint the features from a transferred design on the surface. The hair and part of the clothing may be represented in the same way. The color, however, should always be secondary to the beauty of form and proportion in this work.

O If art museums show fine examples of old carved wood chests from which amateurs may select charming designs. Literature is rich in characters that may be sketched. Plates of animals and bird forms in photographic reproductions from life sketches may be had in the art rooms of any public library.

If the wood carver is fortunate enough to be able to sketch from life, he finds many subjects in our city streets. The "child and pet cat" was sketched first from life, as have been many other figures the writer has carved. You may model in wax or clay first and then make a replica, if that is a more natural mode of expressing for you.

Thus work in wood sculpture has great fascination for the amateur worker. Its crudeness and simplicity are one of its great charms, as well as its durability, which is far greater than that of pottery or porcelain. And when you finally see definite forms emerge from shapeless wood under your fingers, you know something of the joy of the real sculptor.

Mr. Home Workshop

Remarkable Homemade Jewel Casket Contains 1000 Pieces



AMATEUR woodworkers who read the article on inlays, in the August, 1925, issue of POPULAR SCIENCE MONTHLY (page 96) and have experimented sufficiently to undertake a more or less elaborate project, will find that a jewel box or casket offers an especially good opportunity to practise inlaying. The use to which such a box is put warrants an elaboration of detail and ornament that would be out of place in a larger piece of furniture.

A good example of what can be done with a little patience and care is the jewel box illustrated, which was made by Edwin A. Griffin of Hoopston, Ill. It is $3\frac{1}{4}$

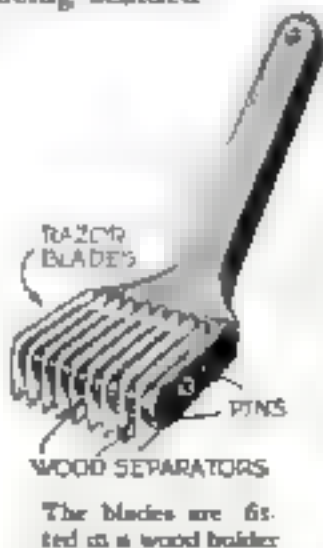


A lavishly inlaid jewel box $3\frac{1}{4}$ by $3\frac{1}{4}$ by 5 in. wide, made by Edwin A. Griffin, Hoopston, Ill.

in. wide, $3\frac{1}{4}$ in. high and 5 in. long, and contains 1000 pieces of wood, including orange orange, sycamore, birch, white holly, black walnut, and Porto Rican wenge wood. The feet were carved with a pocket knife from hard Porto Rican mahogany.

Discarded Safety Razor Blades Used for a Noodle Cutter

DISCARDED safety razor blades, after being scalded and cleaned, are mounted in a wooden holder to form the noodle cutter illustrated. Wood separators hold blades apart. The whole is fastened together by a bolt through the central hole, and two small pins are inserted as indicated to keep the blades in line with each other. F. N. C.



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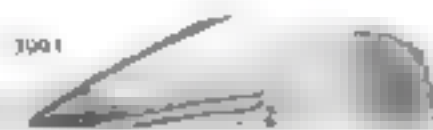
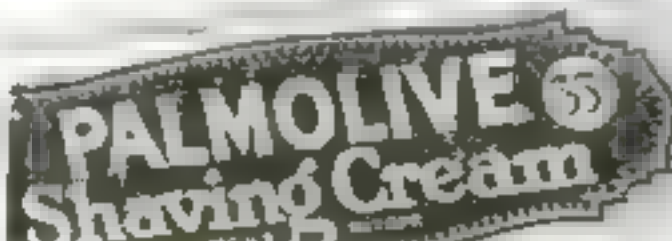
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"YANKEE" TOOLS

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The Home Workshop

A Model Anyone Can Build

(Continued from page 74)

position, the sprit topmast must be upright (Fig. 3). Above this hole, shave the sprit-topmast abruptly to $\frac{1}{4}$ in. and then taper to $\frac{1}{8}$ in. at the top. Put a thin wire binding under the hole and cut off close.

The trucks (X) at the top of the masts are half round $\frac{1}{8}$ -in. button molds, glued on the mastheads and gilded.

The yards taper from the center to the ends; each is a bit smaller than the one below. The flagstaff is about $\frac{1}{4}$ in. all the way up. These spars are all stained dark oak, varnished, and rubbed dull with pumice stone and water.

It is easiest to join the three parts of each mast together before stepping them.

First the tops will be needed (6, Fig. 7). They are cut from the three-ply wood $1\frac{1}{2}$ in. in diameter for the lower tops of the foremast and mainmast, and $1\frac{1}{4}$ in. for the other four, one going on the sprit-topmast. In the center is bored a hole just sufficient to take the mast under

mast in position so that it rests on the cap, and lash it to the top of the lower mast, passing a few turns of the cord between the masts. Invert and nail through the cap into the heel of the top-



Fig. 4. Captain McCann tapers masts and yards by drawing them over a sharp plane.

mast so that they will be slightly apart. A steadying nail may then be driven through the two masts. Fix the topgallant mast on in the same manner.

Insert the assembled masts in the hole in the deck, so that the topmast is before the lower mast, and the topgallant before the topmast.

From the top of the lower mast, run some cords to the ship's sides and bow, to steady it firmly in position—upright but raking slightly aft (leaning backward). The foremast is almost vertical, the main rakes a little more, and the mizen more still.

You will now need 96 deadeyes (J) with which to set up the rigging. They can be made from boxwood, but are more easily made from celluloid knitting needles. They should be about $\frac{1}{2}$ in. in diameter for the lower, and $\frac{3}{8}$ for the upper. With a fretsaw or small file, cut grooves in the needle $\frac{1}{4}$ in., or rather less, apart; then, with the saw or sharp chisel, cut the needle in sections between, not at, the grooves. Then

Continued on page 84.



Fig. 5. Piercing holes in deadeyes, which are made from celluloid knitting needles.

them, on each side are two crescent slots, which are the lubber holes for passing the shrouds through; and on the outside edges, abreast of the mast hole, are two holes in the upper tops and three in the lower. Around each of them, except the one for the sprit, is glued cardboard lattice work, painted scarlet.

To join up the masts, bore a hole in the mast under the point where the top or cap is to come, push an inch of toothpick through it, place the cap on, hold the top

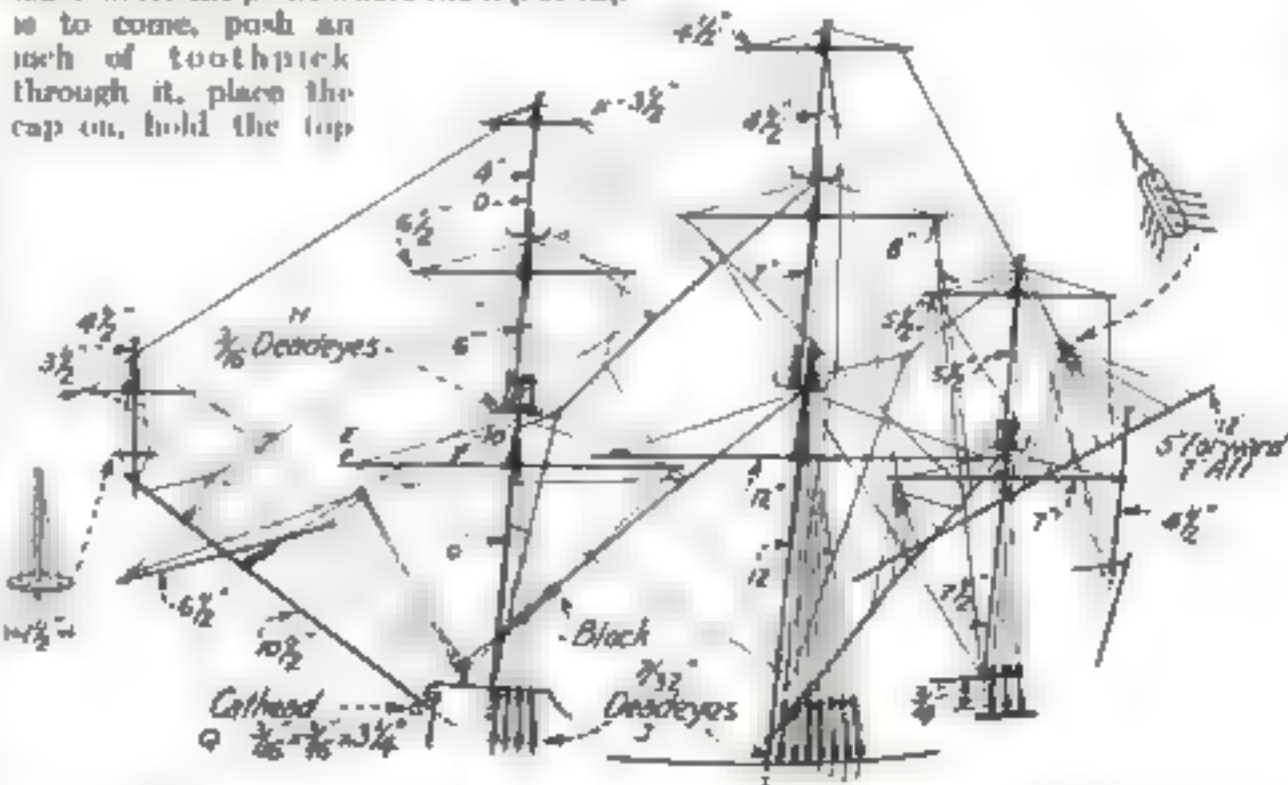


Fig. 3. Showing the masts, yards, bowsprit, shrouds, braces, and stays. The sails are not to suit the yards. Small deviations from the plan will not affect the appearance of the model.

The Home Workshop

A Model Anyone Can Build

(Continued from page 82)

bore a triangle of three holes in each with a hot darning needle (Fig. 3). Celluloid is inflammable and, although the writer has bored hundreds this way without one catching fire, it is essential to take every precaution against a blaze.

To keep the rigging clear of the ship's side, channels are used as at K and L, Fig. 7. These are $\frac{1}{8}$ in. thick by $\frac{1}{4}$ in. deep, of wood, with seven grooves for the main and four grooves for the fore. They are glued and nailed at the lower edge of the bulwark, with the forward groove level with the mast. In line with the grooves, bore holes with an upward slant just above the lower molding.

TAKE No. 20 brass wire, bend it so that it fits snugly in the groove of a deadeye, then carry it down in the groove of the channel and into the hole below, the deadeye being close above the channel. Take a piece of your thick cord, tie a similar deadeye to it, pass the other end up through the lubber hole, around the lower mast, and down, fastening another deadeye to the end so that they both lie even, slightly above the rail.

Take two needles threaded with strong cotton or silk, fasten each thread to one top hole in the deadeye, and carry each through one in the lower, and so on, setting the threads up tight together and fastening off round the shroud above the deadeye. You will find this a simple matter if you study J, Fig. 7.

Turn the model around and do this to the other side, and proceed alternately, first on one side and then the other. As there are uneven numbers at the main and mizzen, the first will be "swifters" and pass over the top and down the other side.

At the mizzenmast there are no channels, or chain plates, so use thin wire around the lower deadeyes, pass it through the edge of the deck, and fasten underneath. Do the same with the deadeyes that come into the tops.

WHEN all the rigging is set up, it will need ratlines (the steps). These are of thick thread, such as button thread. It takes a length to the left hand shroud, pass it in and out of the others and hitch to the right hand shroud, pull the knots tight, but do not draw the shrouds together. When all are on, give the whole rigging a coat of black shellac or enamel and when dry, cut off the ends of the ratlines close to the shrouds.

A needle should be threaded through each shroud close above the deadeyes to keep them from twisting; this is called the sheerpole.

Next will come the stays (Fig. 5). The mainstay starts with a loop through the larger top of the mainmast and runs down almost to the foremast, where it is finished with a large deadeye. Then, from the after hole in the cutwater (behind the lion's tail), comes another loop with a deadeye to meet the mainstay. Set it up tight, like the shrouds.

The mizzen (Continued on page 84)



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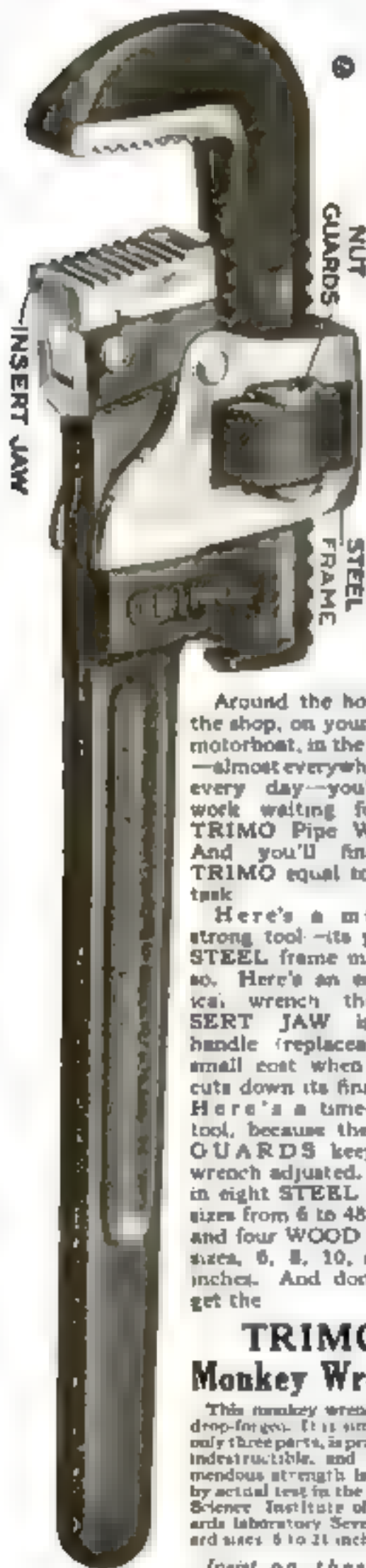
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(Continued from page 82)

stay comes similarly to a loop around the heel of the mainmast.

The main topmast stay, of the lighter cord, comes down through a block (small wooden pulley) under the foretop, and is set up with deadeyes to a screw-eye in the deck by the foremast. The mizen topmast stay is similar. The main topgallant stay comes through a block under the fore-upper top to a block halfway down the main topmast stay, and then finishes in the foretop.

IT WILL be noted that we have not yet shipped the bowsprit, so cannot set up the forestays. This has been left until later, because it is so much in the way.

The sails may be of silk, fine linen, or good mercerized cotton. Straight lines of machine stitching about $\frac{3}{8}$ in. apart, made before cutting, add to the effect. The shapes are given in Fig. 2, and the length of the yards will serve as a guide to the sizes. The sails also are shown accurately to scale on Blueprint No. 47.

They can be plainly hemmed to hang slack, or have fine copper wire stitched in the hems to belly them out. If this is done, leave a short end of wire projecting at the top of the hems, bore holes vertically through the ends of the yardarms, and through these pass the wire. Then buttonhole stitch the sails to the yards. Bore other vertical holes in the center of the yards and about $\frac{1}{4}$ in. beyond the sails.

It is best to paint the devices on the sails before fastening them to the yards, and likewise do the antiquing, if any. The antiquing may be done by dipping the sails in tea or other stain.

To get each yard in position, pass a cord through the center hole and hitch it,

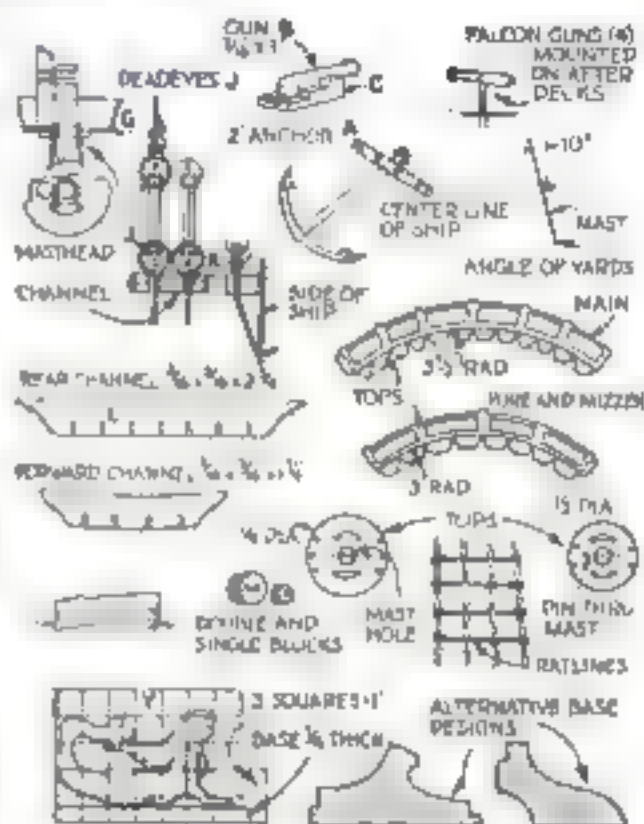


Fig. 7 Mast top, gun anchors, channels, blocks, deadeyes, ratlines, and base blocks

end of the thread to one of the batts; then take the other end around the mast at the yard, hitching it to the halyard on the foremast to act as a parrel (the rope or chain by which the middle of a yard is fastened to the mast).

The lateen sail sets up with a similar halyard 7 in. from the after end and is fastened with a crow's-foot to the mast-head. For the crow's-foot use a cell and block with four holes through it (Fig. 8).

The other blocks are of various sizes, the smallest about $\frac{1}{8}$ in. long and $\frac{1}{16}$ wide. Each has a hole through it the thin way and groove around to the flat way. They are made of any non-splitting wood.

THE yards are maintained horizontal by lifts, which hitch to the masthead and to the holes in the yardarms, leaving a few inches of end to which to fasten blocks for the braces.

To the lower corners of the sails, fasten light cord for sheets; these are fastened to the same holes as the lifts. The sheets of the lower sails are carried to the channels or rigging. The fore end of the lateen yard also needs a double cord to keep it in position.

The braces, of the head cord, are rove off variously, the direction always being aft and slightly downward.

The mizenmast has two preventer backstays, which run to holes in the run near the stern, and the mainmast has one set up with a crow's-foot to the mizen stay.

Now put the bowsprit into its hole in the stem, so that it passes less than an inch above the figurehead, keep it thus by jamming the cathead (Q, Figs. 2 and 3) under it, then tie it down with the gamewinning (lashing) to the forward hole in the cutwater.

(Continued on page 85)



Fig. 8 The flags, which are a trifle more than a third full size and other decorations

leaving plenty of end, then pass it through a hole in the mast under the top and down to the deck, setting up with blocks. The head twist and both single and double blocks can be used. The lower block is fastened to screw-eyes in the deck and the

A Model Anyone Can Build

(Continued from page 84)

Set up the forestay from under the top to about halfway out on the bowsprit, and the foretopmast stay to near the end, and the fore topgallant stay to the top of the sprit-topmast.

Hang the spritsail yard under the bowsprit just before the forestay. It has a foreward brace and lift in one, from one third of the way up the forestay to a block at the yardarm, to another at the bowsprit end, and back to the fore hittle; and another brace from the hittle to the yardarm and back.

THE sprit topsail has a halyard to the masthead and down to the top, as well as topping lifts to the masthead and braces from the topmast stay to the yardarm, back to the stay, and fast to the fore hittle.

These old sails used to set so badly that they all had bowlines to pull the leeches (edges of the sails) forward. For these the head silk is used, with beads for leads, arranged in crew's-foot form, as shown by dotted lines in Fig. 2. These are fitted to all sails on main, fore and mizen masts.

The yards may be trimmed to lie straight across the ship, as if with the wind aft, but I think they look better if braced in a bit, for a wind on the quarter (Fig. 1).

Now lash the anchors to the fore rigging, pass pieces of your heaviest cord through the rings, twist them up, give the ends, and pass them around the cat-heads and through the hawse pipes.

Place all the fittings and the handrails in position. Paint the flags (Fig. 6) on thin, starched silk, run a line of clear shellac or glue around the edges to prevent fraying, and cut them out. Glue each to a long gilded belt pin, and set in holes in the tops of the masts. The flags are shown full size on Blueprint No. 47.

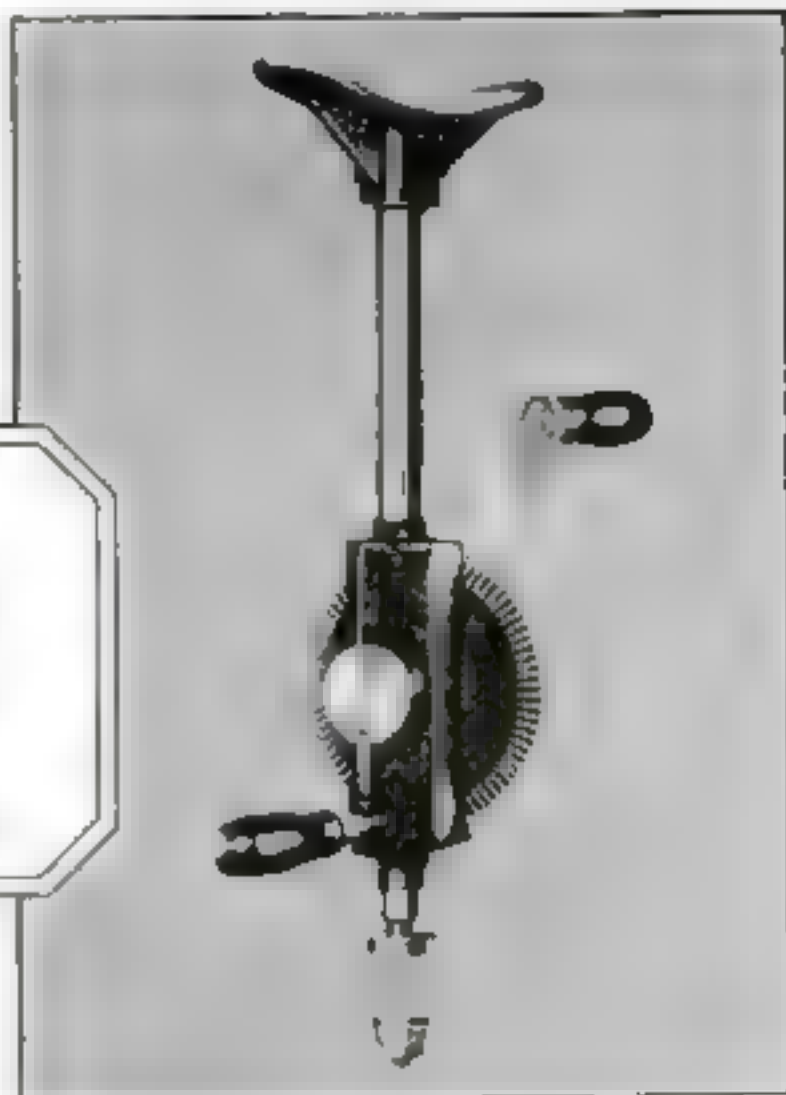
THE base supports (Y, Fig. 7) for the model can be anything you fancy, with $\frac{3}{4}$ -in. slots to take the keel. They can be fastened to a board, so that the model sits in them loosely, or can be separated and screwed fast to the keel.

You will perhaps be interested in looking up a plan of a square-rigged ship in a dictionary, or encyclopaedia—it will add interest and make the work easier.

To do all this takes care and perseverance. You will have to be both craftsman and artist, but the result is very well worth it. You will never regret the work, and you may have something that will be a joy to you, the admiration of your friends, and an asset of considerable artistic as well as monetary value.

"Best of Its Kind"

IT GIVES me great pleasure to forward to you a photograph of the Pirate Ship Model built by me from your plans and blueprints (Nos. 44 and 45). In regard to the magazine, I consider it the best of its kind published. E. K., Berlin, Pa.



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The Home Workshop

To Make Woodwork Look New

(Continued from page 1)

flush panels, so I had Dan start across the top of the door and lay on the enamel crosswise, brushing from the dry part toward the fresh enamel, watching always that the enamel went on heavy enough to be full bodied, but not enough to cause it to sag down or form curtains. If this happens, the only cure is to wash off the work with turpentine, let it dry, and start over again. If only a small sag appears, let it dry for a week and then sand down level with wet sand paper. The whole work then would have to be sanded all over and re-enamelled.

If the door had been made with the usual recessed panels, the following method would have been followed:

First, enamel the molding around the top panel and the panel itself, brushing from the ends toward the center. Second, enamel the center stile between the top panels, cutting the work sharp off at the ends of the stile when it joins the cross rail. Third, enamel molding and panel of second top panel. Fourth, enamel top cross rail and second cross rail just below panels freshly covered. Fifth, repeat moldings and panels, cross rails and center stiles until the bottom cross rail is finished. Last, enamel both lock and hinge stiles.

ALL this work should be done as rapidly as possible, using only a few brush strokes and avoiding all "fussiness" in order that the enamel will flow naturally.

This method was applied to the fireplace, the hearth of which was first sprinkled to keep down possible dust. The shelf of the mantel was enamelled then the bed molding next the panel and its surrounding molding, and so on down to the hearth. To keep undercoating and enamel off the face work, a postal card was used as a "follower." This prevented the brush from touching the bricks.

"Bring your drop cloths, Dan, and we will go into the library and fill the new woodwork ready for varnishing." I said when we had done all we could on the mantel. "Here we have figured brown ash, and I want a fairly light golden brown with simply enough finish to per-

fect the wood and allow the grain to show."

I then showed Dan how to thin the enamel filler with a liquid made of two thirds gasoline and one third turpentine until it was as thick as condensed milk. We added raw sienna and a little burnt umber until the color was satisfactory.

A good steady brush was used to apply the filler generously and thoroughly, after which it was allowed to set until the "shine" of the turpentine was gone.

Dan then made up a pad of burlap and rubbed the filler in thoroughly, after which the remainder was cleaned off with squares of burlap, all the work being done across the grain. The corners were cleaned out with a soft pine stick and,

as a final touch, a soft cloth was used to go over the work to make sure no traces of free filler were left anywhere.

"**H**OW long does the filler have to dry?" asked Dan.

"Forty-eight hours after which we shall apply a coat of orange shellac to give an aged golden or russet tone to the work. This will be made from ordinary stock reduced with two volumes of denatured alcohol. A flat brush will be needed, and as little brushing as possible must be done in order to avoid 'piling up' the quick-drying shellac. This will have to dry half a day, and then should be sanded with a split

Number 40 or 60 paper until smooth.

A tacky cloth is used to follow the dusting brush, and then a coat of flat or egg-shell varnish can be applied with the flat brush."

When all this had been outlined to Dan, he felt confident he could do the finishing necessary in his own home. And indeed any reader can do the same if he will follow the steps one at a time and not try to hurry the work unduly.

I HAVE made a good many things that I have learned how to build from POPULAR SCIENCE MONTHLY. I have made footstools with springs, balracks, kitchen tables, workshop bench, writing desk, chest, tool cabinet, trellises for the house, just in my spare time, and I am very much interested in your magazine.
J. J. B., Binghamton, N. Y.



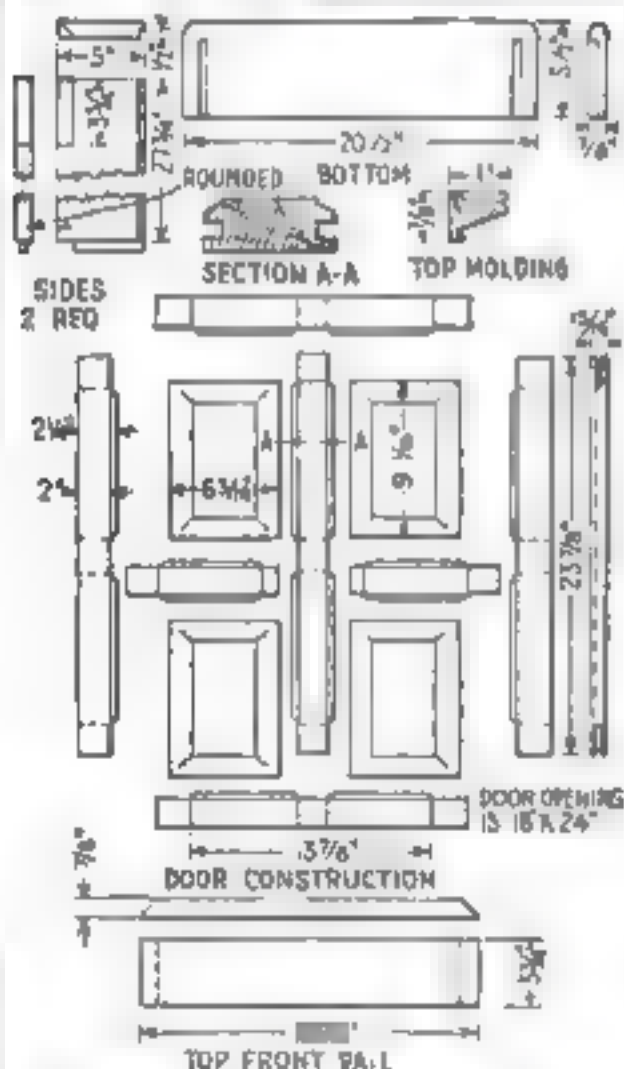
After the filler had dried, the library door was varnished with strokes carried clear across.

Neat Wall Cabinet for Medicines or Spices

BASSWOOD and clear white pine are excellent woods to use in constructing the wall cabinet illustrated, as they take an exceptionally smooth finish.

While originally intended as an extra medicine case, the cabinet can be used for spices in the kitchen or for other purposes. A mirror could be inserted in the door frame instead of the four panels, without changing the remainder of the design.

Each of the side pieces is made as shown, with a tenon at the lower end and a $\frac{1}{2}$ by $\frac{3}{4}$ in. dado running the entire length of the inside back edge. This dado takes the back, which is a piece of $\frac{3}{4}$ -in.-thick 3-ply veneer. On the



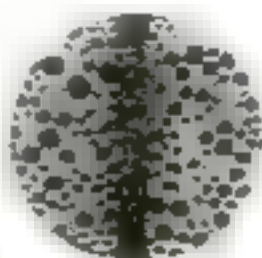
The finished cabinet and details of its main frame, door construction and molding for top

front edge of each side piece a miter is cut for a distance of $3\frac{1}{4}$ in. from the upper end. This joins neatly with the mitered end of the top front rail.

The construction of the door is shown in detail. It is hung with 2 by 2 in. brass bolts. A spring ball-and-socket catch is used to keep the door closed, and a glass knob is provided.

Three shelves $\frac{1}{2}$ in. thick are fastened in the cabinet by inserting screweyes into the sides under each. W. J. E.

See what happens when you soften the beard at the base



ORDINARY LATHER
Photomicrograph of lather of an ordinary shaving cream surrounding single hair. Large dark spots are air—white areas are water. See how the large bubbles hold air instead of water against the beard.



COLGATE LATHER
Photomicrograph prepared under identical conditions shows fine, closely knit texture of Colgate's Rapid Shave Cream lather. Notice how the small bubbles hold water instead of air close against the beard.

Here is a shaving cream in concentrated form—super water-absorbent—that softens the beard at the base where the razor does its work—that penetrates right to the bottom of every hair and soaks it soft with water.

SOME lathers merely cover the horny surface of your beard. Others go partly through. But here is a lather that actually penetrates deep down to the base of every hair—and soaks it soft with water.

Colgate's softens the beard in the only scientific way—by saturating it with moisture right where the razor does its work. And remember, water, not shaving cream, is the real softener of your beard.

It is really shaving cream in concentrated form—different in action and result from anything you have ever known before.

In this lather the bubbles are smaller, as the microscope shows, they hold more water and much less air; they give more points of moisture contact with the beard.

So that this moisture may soak right into the beard, Colgate's first emulsifies and removes the oil film that covers every hair.

Then quickly thousands of clinging, moisture-laden bubbles penetrate deep down to the base of the beard—

bring and hold an abundant supply of water in direct contact with the bottom of every hair.

Thus the entire beard becomes wringing wet—moist and pliable—softened at the base, where the razor does its work. In this way the beard becomes properly softened right where the cutting takes place. "Razor-pull" is entirely banished.

In addition, Colgate lather lubricates the path of the razor—makes it glide across your face without catching or dragging. And it leaves your skin clean, cool and comfortable throughout the day.

A new shaving experience awaits you

If you want a quick, smooth shave every morning, clip the coupon below and let us mail you a generous trial-size tube of Colgate's.

Then compare it with any other shaving cream you may have used—note the remarkable difference. Find out what this new shaving method offers. See coupon below.



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the beard
at the base

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Established 1806
NEW YORK

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COLGATE & CO.
Dept. 143-P, 361 Fifth Ave., New York
Please send me the trial tube of Colgate's
Rapid-Shave Cream for better shaving
I enclose 4c.

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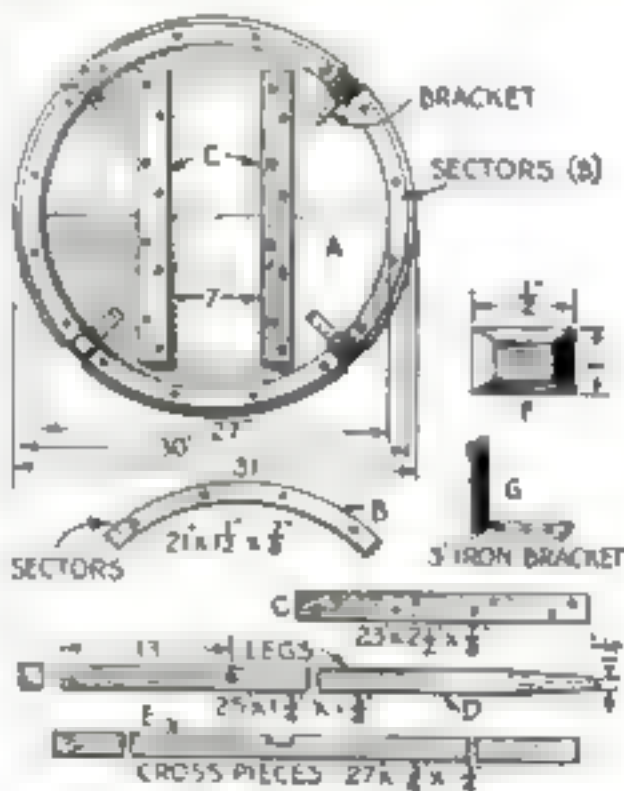
Worth While
TOOLS

A Vermilion Coffee Table Is Simple Piece to Build

By HAROLD MOORE

MANY amateur woodworkers, I feel sure, would enjoy constructing a Russian coffee-table similar to the one illustrated. In making it, I copied a rare antique recently brought over from Russia. I had seen the original in an artist's studio and been struck with its picturesque appearance. Its brilliant red hue made it the most colorful piece in a room of exceptional brilliance and beauty.

The top, A, was made from two pieces of whitewood $\frac{1}{2}$ by 10 by 34 in. These were dovetailed together and glued in the usual way. Three concentric circles, 27,



Except for the dovetailed joint in the tabletop, all the parts are put together with screws.

30 and 31 in. in diameter, were drawn on it, as well as two center lines at right angles to each other.

Next, the four sector pieces B were cut from a $\frac{1}{2}$ by 6 in. board after they had been marked from a pattern taken from the inside of the 30-in. circle drawn on the table bottom. They proved to be $1\frac{1}{4}$ in. wide and 21 in. long over all, when finished. These were glued and screwed on the underside of the tabletop, each with four $1\frac{1}{2}$ -in. flat-head wood screws.

The batten pieces, C, $\frac{1}{2}$ by $2\frac{1}{2}$ by 23 in., were placed 7 in. apart.

The four legs, D, $1\frac{1}{4}$ by $1\frac{1}{4}$ by 25 in., were beveled for 7 in. at one end to give a $1\frac{1}{4}$ -in. foot at the bottom.

The two crosspieces, E, were half

Bill of Materials for Russian Coffee Table

Parts	Pieces	T	W.	L.
A Table top, whitewood	2	34	10	34
B Sectors, whitewood	4	21	6	1
C Battens, whitewood	2	23	7	1
D Legs, pine or white wood	4	25	1	25
E Crosspieces, pine or whitewood	2	23	1	2
F Brackets, whitewood	4	1	1	1
G Angle brackets, iron, 3-in.	4			
All flat head wood screws 1 in. long and 4 flat head wood screws 1 in. long and 4 glue, dowels, casters and finishing materials are required.				
All dimensions are in inches.				

lapped together at the center and fastened with $1\frac{1}{2}$ -in. wood screws and glue. A $\frac{1}{4}$ -in. hole was bored through the four legs 15 in. from the top and countersunk so that the screw would go in perfectly flush. Four $2\frac{1}{4}$ -in. wood screws were put through the four legs into the crosspieces.

Four square holes $1\frac{1}{4}$ by $1\frac{1}{4}$ in. were cut at the edge of the tabletop for the legs to come up right through the top. They stuck up above the level of the table $\frac{1}{2}$ in. the sharp edges being sanded off. In cutting these openings for the legs, I used a hacksaw and made the holes about 1 in. size, trimming them with a fine wood file. This insured a snug fit.

After gluing the legs in, four iron brackets, G, were screwed in place between the tabletop and legs. Then the brackets, F, with beveled edges, were glued over the screw holes in the legs to give the effect of a tenon coming through the legs. Four roller casters with a square base were attached to the legs.

The table now was sandpapered carefully, given a coat of paste filler, and sanded again. Then three coats of genuine vermillion-color enamel were applied, the first two coats being rubbed down with very fine, worn sandpaper.

Water Heater for Summer Use Costs Less Than \$10

WHEN the furnace is allowed to go out in the spring, I heat water by means of a homemade coil placed in a small, airtight, sheet iron stove. Newspapers, rubbish and scraps make up most of the fuel, so that it costs nothing to keep the water warm.

The materials used were 30 ft. of $\frac{1}{2}$ -in. water pipe, a 4-ft. length of $\frac{1}{4}$ -in. water pipe with a T screwed on one end and two $\frac{1}{2}$ -in. unions. The $\frac{1}{2}$ -in. pipe was bent into as small a coil as possible by using the T on the 4-ft. pipe as a bending tool. The top end was turned up and the lower end left straight, both being on the same side. As the coil was larger than the fuel hole in the stove, it had to be turned into it like a screw.

Making a hole in the back of the stove near the bottom, I connected the coil to the cold water line. The upper end was connected to the tank by running 4 ft. of the outlet pipe up the stovepipe and then over to the tank. The entire cost was less than \$10. P. BORSFORD.

The Home Workshop

How to Send Coins Safely through the Mails

By KENNETH B. MURRAY



GOVERNMENT reports show that thousands of dollars sent through the mails are lost yearly. Usually the loss is due to carelessness in preparing currency to withstand the necessary handling, the passage through the canceling machines, and the rubbing and abrasion of transportation.

The illustrations above show tried and simple expedients by which small coins can be mailed safely. The method in the upper view is to cut a hole in a piece of cardboard, insert the coin and cover both sides of the hole with adhesive paper.

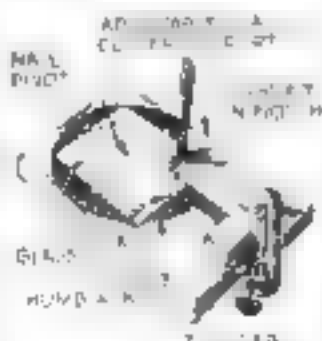
In the lower left-hand view the coin is fastened directly to a corner of the letter with a piece of adhesive tape.

The remaining view illustrates a coin pocket that can be made from the top half of a letter by folding in the top corners to the center, and then folding the entire sheet at the middle. The coin will remain in the pocket thus formed.

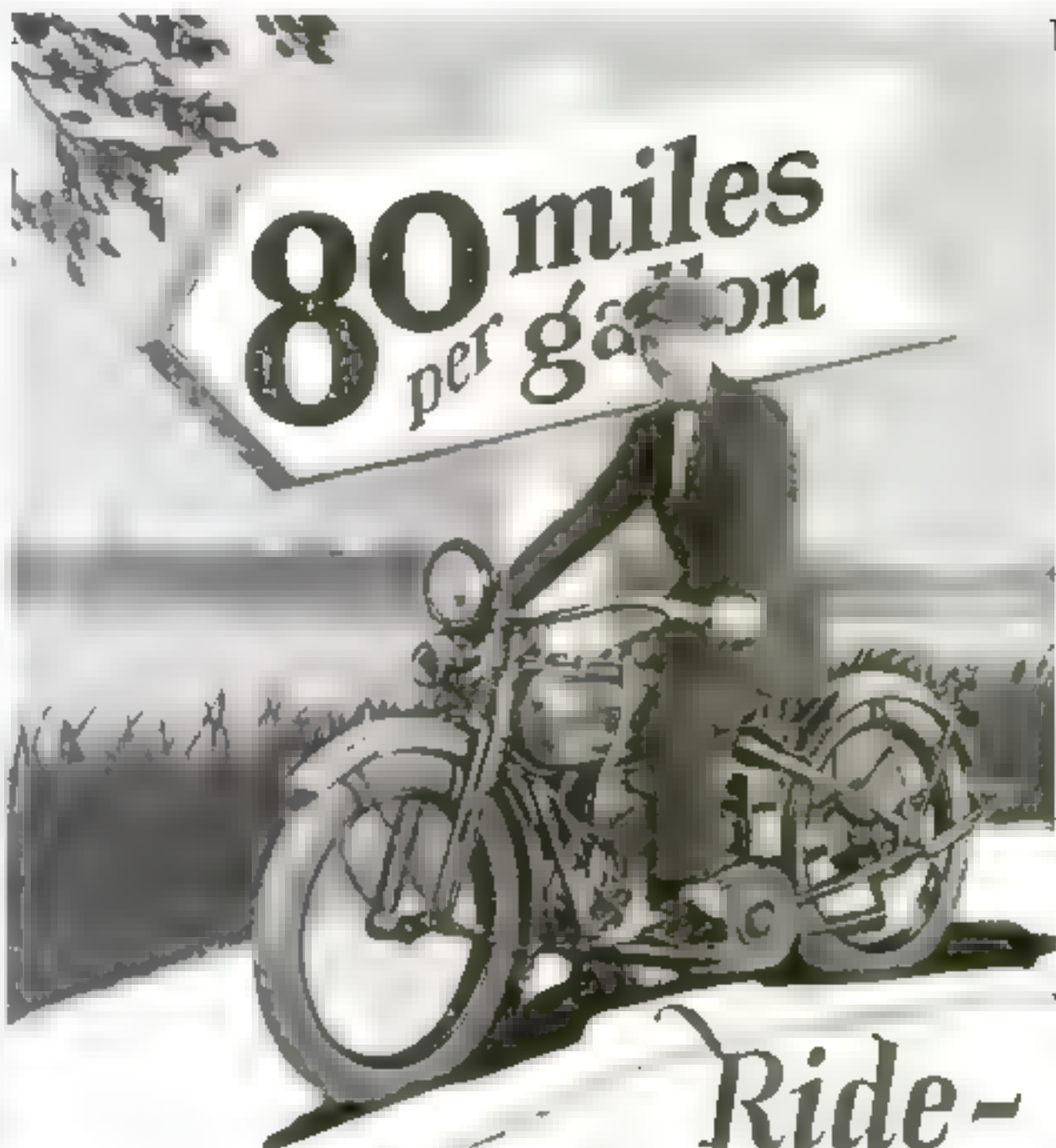
Cutting Circles of Glass

WHEN a circular glass cutter is not available, the home worker can rig up a simple device for cutting a circle of glass with an ordinary steel glass cutter or a diamond. The cutter is wedged tightly into a notch in a stick of wood and clamped so that it will be over an improvised turntable.

Several sheets of newspaper are laid on the turntable and the glass placed on top of them and held in position with thumbtacks. The cutter then is adjusted so that it will cut a circle of the right diameter and is locked in place with a C clamp. While pressure is applied to the cutter, the turntable and glass are revolved beneath it. Straight cuts then are made from the circumference to the corners of the glass and the waste parts are broken off.—J. D. G.



The cutting set-up



Ride— at 1/7 the Cost!

ONLY one cent per mile—the most inexpensive of costs seven times more to ride. Far less than carfare or busfare—the lowest cost power travel.

Dependable. Sturdy 4-cycle motor of ample power and acceleration. 1—two speed sliding gear transmission.

Easy to Ride—easier than a bicycle. You'll learn in the length of a city block. Almost self balancing.

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We want a live dealer in every locality. A money-making opportunity for real workers. If interested, check the coupon.

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() Send me free literature about the new Single.
() Tell me about your dealer proposition.

Name

Address

The Home Workshop

My Workshop Gave Me a House

(Continued from p. 8)

of the former happened when I was nailing and placing window frames. I got the pulley stiles for two windows mixed so that each frame had one stile two inches longer than the other. I failed to notice my error until the two frames were made and nailed in place and I happened to look at the house from the outside.

One tragic error at the beginning came near killing my desire to build. As I was working alone, I built my frame in sections flat on the floor and pulled them up in place with block and tackle. I erected my first section one evening and braced it well so that it would stand until I should return to work the following evening.

When I went back the next evening, I loosened the braces and had just commenced work when a shower came up. I rushed home, forgetting to nail my frames in place again.

When I returned the next day I found the entire section of frame blown down so badly that it had to be torn to pieces and rebuilt.

I got my biggest thrill when the last trowelful of plaster went on the walls. I had never handled a plasterer's trowel before I started plastering my house. All kinds of sad results had been predicted if I tried plastering without experience, so I was just a little doubtful about attempting the job. I watched plasterers working whenever I had a chance, and asked questions. I wrote to the plaster manufacturers and got a lot of instructions on making and applying plaster.

I WAS still undecided as to whether to attempt the plastering job or not. Most plasterers I talked to tried to dissuade me, but finally one old man who had plastered for years said to me:

"Why, yes, I'd do it myself, if I were you. You know it doesn't take a man with a college education to put plaster on right. You look like you have a good strong back!"

So I went to work plastering. By starting in with the smaller rooms and learning how to handle the trowel and to spread the plaster on evenly there, I had acquired the knack of doing a fairly good job by the time I reached the larger rooms. Mandy I had learned to keep the work moving so that the plaster would

not set beyond all possible troweling.

Most of our furniture was built by lamplight. I had a lot of problems to solve in making the various pieces. For instance, the lack of proper tools puzzled me. If I wanted to make a turning, the closest lathe was in a high school twenty-five miles away and I didn't have access to that. I puzzled over what I should do about turnings for many months, and every time I got a chance would go to a library and search for methods of making them.

Finally I found a few hints as to how fine spiral turnings could be made by the

use of a lathe and a few simple tools. I modified the lathe process so that I can now make such turnings by hand whenever I wish.



A walnut chair made entirely by hand, including turnings and carving by Mr. Deering. To look at it one would not suspect the first table he built was constructed so poorly it fell apart as soon as it was made.

GETTING proper wood for the making of furniture bothered me, until I started ripping out the heavier pieces from the original walnut logs. It really isn't so hard if the logs are well cured and have been split in sections.

When I look at our furniture I often marvel at what I have been able to accomplish with so few tools. Being without the necessary tools was once my despair, but I believe it really helped me to do better work, for I have learned so many useful things I would not know if it had not been necessary to

make the best of few tools.

When I started plastering the house, cold weather had come. Sometimes it was necessary to have a fire to keep the plaster from freezing.

I spent Thanksgiving Day plastering. Before Christmas, I decided the plaster was dry enough to move into the house.

We took in some of the furniture I had made. A bad storm was brewing outside, so we got only a few pieces of furniture in that evening. The temperature was dropping and before midnight was twenty degrees below zero.

Inside, we had a fire going, and were warm and happy. We were having the thrill that comes only once a lifetime. We were sitting comfortably by our own fireside while outside a winter's storm was howling. All our effort and back-breaking toil to get a home seemed repaid a thousandfold in two hours that winter night.

"ATKINS"
Whenever You
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A ^{NEW} ATKINS Hack

ATKINS Hack

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Just try a "New Break"
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Home Workshop

Box for Carrying Tools from Job to Job

HANDY men who do a number of repair jobs inside and outside the house, as well as carpenters engaged in framing new buildings and similar work, find it desirable to have a box for carrying around the necessary tools. The one illustrated answers this purpose better than



Toolbox has divisions for saws and planes also two drawers for chisels and small tools

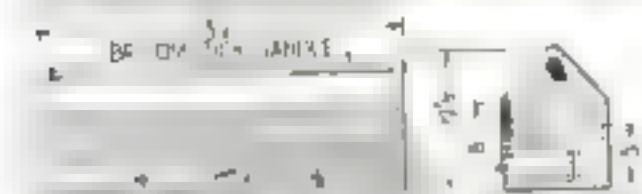
most, yet it is of the simplest construction. Among its advantageous features are a separate compartment for saws and steel square, plenty of space for planes, level, bit brace, and other large tools, and two drawers for small tools.

The materials needed are $\frac{3}{4}$ - and $\frac{1}{2}$ -in. thick white pine or other soft wood stock, two drawer knobs or pulls, a catch for holding the drawers in place, and a brass handle or other long, round rod of sufficient strength to support the weight.

The bottom piece is set into a rabbet in the ends, and the front and back pieces also are set in rabbets. This construction is strong enough to withstand hard usage.

Most boxes of this sort, not being stained or painted, soon become grimy

COMPARTMENT FOR SAWS, FRAMING SQUARES, ETC. TOP VIEW OF DRAWER



BELOW: DRAWER FOR CHISELS AND GROUND FOR DRILLS, BITS, AND NAIL SETS. BOTTOM: DRAWER FOR OTHER STOCK

Top, front, and end views of the tool-carrying box and detail of drawer construction

If you wish to keep the box the natural color of the wood, by all means give it a thin coat or two of white shellac. The pleasure of having a clean, neat looking toolbox will more than repay you for this slight trouble.—KENNETH R. LAVOT.

Making Use of Old Auto Seats

TO MAKE a comfortable settee I mounted two discarded back seats from a seven-passenger car on the edges of two oak boards about 5 in. wide. As the upholstery is of the finest quality, the settee is most comfortable. Auto seats from discarded cars cost little and can be used in various ways. Two can be mounted on a lawn swing for the summer and taken indoors in the fall to form a fireplace seat. H. I. BRUNDAGE.



"Tell him I'm out"

SHE had seen him just in time . . . just in time to avoid another unpleasant afternoon. She couldn't dislike the man, yet she hated to be with him . . . hated to be seen with him. She wondered he did not suspect the reason she was so often "out."

A great many young men are inclined to have a grimy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clear, ruddy complexion.

Cleans the Skin. Pompeian Massage Cream thoroughly cleanses the pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to Use. After shaving or washing, rub it in gently. Continue rubbing and it rolls out, bringing with it all the dirt and skin impurities. Result—a clean, healthy skin with clear, glowing color.



Use Pompeian Massage Cream regularly at home—then you'll get the full benefit. At all druggists.

SPECIAL INTRODUCTORY OFFER

$\frac{1}{3}$ of 60c jar for 10c



For 10c we send a special Trial Jar containing one-third of regular 60c jar. Contains sufficient Pompeian Massage Cream to test thoroughly its wonderful benefits. Position only one as to a family on this exceptional offer.

THE POMPEIAN CO., Cleveland, O., Dept. 66

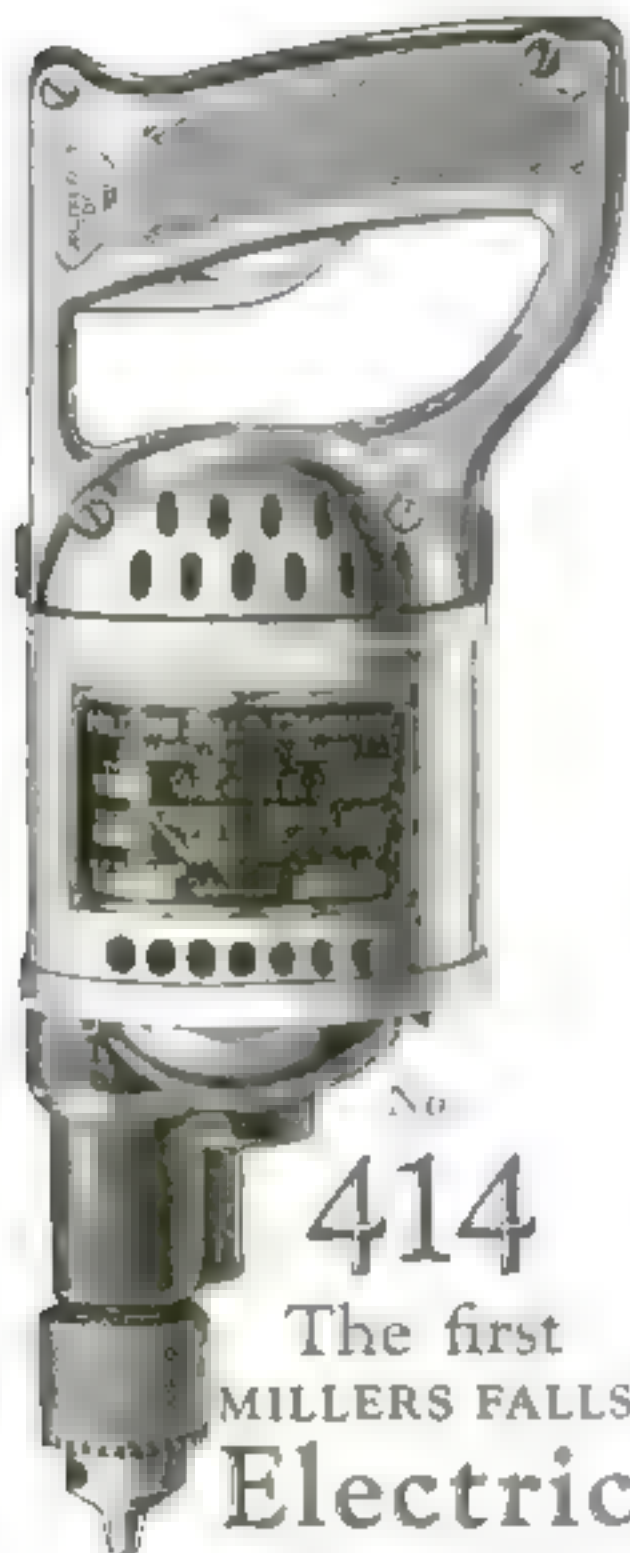
Gentlemen I enclose a check 10c for $\frac{1}{3}$ of a jar of Pompeian Massage Cream

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No. 414 The first MILLERS FALLS Electric Drill

FOR fifty years Millers Falls Company have made hand, breast, chain and bench drills.

To take up the manufacture of portable electric drills was a natural step forward. It depended on one thing—the development of an electric tool of true Millers Falls quality.

Here it is—the first number of a series. Look for it in hardware and automobile supply stores. It's a fine tool—what more can we say than that it belongs to the Millers Falls group?

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The Home Workshop

I Add a Tilting Saw Table to My Home Machine Shop

By OWEN LOVEJOY

SIMPLE and inexpensive as it is, this removable tilting table makes a small circular saw practical for much of the work of the home mechanic, both ripping and crosscutting. It can be lifted off when not in use, so as to leave the bench available for other kinds of work—a factor of importance in the small shop where working space is at a premium. It costs almost nothing to build, and can be set up in a short time by any man handy with ordinary tools.

The table itself is a pine board 7 by 18½ in. The rear end is fixed to another piece at right angles, so as to be held just 8 in. above the workbench. This height accommodates the writer's mauler (a polishing head), which is 6 in. high.

The 8-in. upright fits snugly into a recess in the front of a stationary piece fastened to the bench, so as to allow the table to be tilted up and down without moving sideways (Fig. 8).

The tilting is easy to accomplish by means of a piece of strap steel 13 in. long fastened by screws to a wooden block, which is screwed in turn to the bottom of the table. This strap slips up and down on the front face or apron of the workbench, steadied by a small block at the bottom.

Adjustment is effected by a small bolt working through another piece of strap steel, which is bent and screwed to the bench. The writer cut slots in either side of the bolt head with a hacksaw and fitted another piece of strap steel over the head, so as to be able to turn the bolt without a wrench.

A saw with fairly large teeth was selected, so that it would be suitable for either ripping or crosscutting on such small work as the



Fig. 1. Ripping on improvised saw table. Saw is mounted on a cheap polishing head.

home mechanic ordinarily has to do.

For crosscut work a T was made of two pieces of oak. The front edge was set at exact right angles with the saw blade. The T can be set at other angles, as for mitering.

To operate, the piece to be sawed is held firmly against the straight edge of the guide—the head of which rides along the side of the table (Fig. 9). For accurate dimensions it has been found best to mark the boards carefully before attempting to cut them.

For ripping, the T is simply placed at the end of the table and clamped firmly to form a guide fence (Fig. 1).

With this outfit, the writer does all kinds of work to which a fair degree of accuracy is desired. He has practically eliminated hand sawing in his home workshop.

In furniture making and light cabinet work, this saw has proved a valuable aid.

How Mr. Lovejoy uses the other end of the polishing head as a lathe was described last month, page 95.

Utilizing a Tool Grinder in Unusual Ways

MANY ways of utilizing an old tool grinder will suggest themselves to those who have one but who do not possess a lathe. The writer has found it extremely useful when painting small wheels for toys, especially the tires. These wheels are made from spools, which will fit over the spindle of the grinder. A narrow, even band of color can be applied merely by holding the brush against the wheel while it revolves.—S. J. CRAWLEY.



Fig. 3. In crosscutting, the stock is held against a wooden rest which slides along the top and side of the table like a T square.

The Home Workshop

Blueprints Show How to Build Ship Models Successfully

IF YOU missed the first part of Captain E. Armitage McCann's remarkable article on building a Spanish galleon in the May issue, you still can construct a replica of this beautiful ship without difficulty. Read the second part of the article, beginning on page 74 of this month's issue, and send for the two blueprints marked 46 and 47 on the list below.

Everyone who attempts to build the model should have both blueprints. No. 46 shows the hull full size and can be used as a template in marking the wood. Blueprint No. 47 pictures the rigging, sails, cannon, flags, ornaments and small details.

The photograph on page 74 will show you at a glance what a strikingly decorative model this galleon is. No other model has been designed that is at once so thoroughly authentic and so cleverly simplified to suit the skill of the beginner in model making.

Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.

Popular Science Monthly

250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below, for which I inclose..... cents

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4	Kitchen Cabinet	May	22 25c
5	Shaving Cabinet	June	22 25c
6	Arbor, Gate and Seats	July	22 25c
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28	Pullman Play Table	Nov.	23 25c
29	Toy Tea Cart, etc.	Dec.	23 25c
30	Tool Cabinet, etc.	Jan.	24 25c
31	Sewing Cabinets	Feb.	24 25c
32	Chinese Game Table	Mar.	24 25c
33	Dining Arcade	Apr.	24 25c
34	Garden Trellises	May	24 25c
35	Simple Radio Cabinet	Oct.	24 25c
36	Rush Bottom Chair	Nov.	24 25c
37	Simplified Bookcase	Dec.	24 25c
38	Sheraton Table	Jan.	25 25c
39	Salem Chest	Feb.	25 25c
40	Desk in Sheraton Style	Mar.	25 25c
41	One Tube Radio Set	May	25 25c
42	Three Stage Amplifier	June	25 25c
43	Four Tube Receiver	July	25 25c
44	Pirate Ship Model - Hull	Feb.	26 25c
45	Pirate Ship - Details	Mar.	26 25c
46	Galleon Model - Hull	May	26 25c
47	Galleon Model - Details	May	26 25c

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City and State _____



The Telephone at the Centennial

ONE hundred years after the signing of the Declaration of Independence, the infant telephone was first exhibited at the Philadelphia Exposition.

Since the dawn of civilization, mankind had sought some means of communicating over distances which unaided human speech could not bridge. Drums, signal fires, runners, the pony express, and finally the electric telegraph were means to get the message through. It remained for the telephone to convey a speaker's words and

tones over thousands of miles.

"My God, it talks!" exclaimed the Emperor of Brazil before a group of scientists at the Philadelphia Exposition, as he recognized the voice of Alexander Graham Bell, demonstrating the new invention.

Today, after a brief half-century, the telephone lines of the Bell System have become the nerves of the nation. The telephone connects citizen with citizen, city with city, state with state for the peace and prosperity of all.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY AND ASSOCIATED COMPANIES

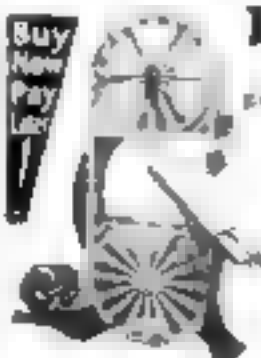
BELL SYSTEM



IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

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Read the Money Making Opportunities on pages 110 to 135 of this issue.



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1176, 1182, 1188, 1194, 1200, 1206, 1212, 1218, 1224, 1230, 1236, 1242, 1248, 1254, 1260, 1266, 1272, 1278, 1284, 1290, 1296, 1302, 1308, 1314, 1320, 1326, 1332, 1338, 1344, 1350, 1356, 1362, 1368, 1374, 1380, 1386, 1392, 1398, 1404, 1410, 1416, 1422, 1428, 1434, 1440, 1446, 1452, 1458, 1464, 1470, 1476, 1482, 1488, 1494, 1500, 1506, 1512, 1518, 1524, 1530, 1536, 1542, 1548, 1554, 1560, 1566, 1572, 1578, 1584, 1590, 1596, 1602, 1608, 1614, 1620, 1626, 1632, 1638, 1644, 1650, 1656, 1662, 1668, 1674, 1680, 1686, 1692, 1698, 1704, 1710, 1716, 1722, 1728, 1734, 1740, 1746, 1752, 1758, 1764, 1770, 1776, 1782, 1788, 1794, 1800, 1806, 1812, 1818, 1824, 1830, 1836, 1842, 1848, 1854, 1860, 1866, 1872, 1878, 1884, 1890, 1896, 1902, 1908, 1914, 1920, 1926, 1932, 1938, 1944, 1950, 1956, 1962, 1968, 1974, 1980, 1986, 1992, 1998, 2004, 2010, 2016, 2022, 2028, 2034, 2040, 2046, 2052, 2058, 2064, 2070, 2076, 2082, 2088, 2094, 2100, 2106, 2112, 2118, 2124, 2130, 2136, 2142, 2148, 2154, 2160, 2166, 2172, 2178, 2184, 2190, 2196, 2202, 2208, 2214, 2220, 2226, 2232, 2238, 2244, 2250, 2256, 2262, 2268, 2274, 2280, 2286, 2292, 2298, 2304, 2310, 2316, 2322, 2328, 2334, 2340, 2346, 2352, 2358, 2364, 2370, 2376, 2382, 2388, 2394, 2400, 2406, 2412, 2418, 2424, 2430, 2436, 2442, 2448, 2454, 2460, 2466, 2472, 2478, 2484, 2490, 2496, 2502, 2508, 2514, 2520, 2526, 2532, 2538, 2544, 2550, 2556, 2562, 2568, 2574, 2580, 2586, 2592, 2598, 2604, 2610, 2616, 2622, 2628, 2634, 2640, 2646, 2652, 2658, 2664, 2670, 2676, 2682, 2688, 2694, 2700, 2706, 2712, 2718, 2724, 2730, 2736, 2742, 2748, 2754, 2760, 2766, 2772, 2778, 2784, 2790, 2796, 2802, 2808, 2814, 2820, 2826, 2832, 2838, 2844, 2850, 2856, 2862, 2868, 2874, 2880, 2886, 2892, 2898, 2904, 2910, 2916, 2922, 2928, 2934, 2940, 2946, 2952, 2958, 2964, 2970, 2976, 2982, 2988, 2994, 3000, 3006, 3012, 3018, 3024, 3030, 3036, 3042, 3048, 3054, 3060, 3066, 3072, 3078, 3084, 3090, 3096, 3102, 3108, 3114, 3120, 3126, 3132, 3138, 3144, 3150, 3156, 3162, 3168, 3174, 3180, 3186, 3192, 3198, 3204, 3210, 3216, 3222, 3228, 3234, 3240, 3246, 3252, 3258, 3264, 3270, 3276, 3282, 3288, 3294, 3300, 3306, 3312, 3318, 3324, 3330, 3336, 3342, 3348, 3354, 3360, 3366, 3372, 3378, 3384, 3390, 3396, 3402, 3408, 3414, 3420, 3426, 3432, 3438, 3444, 3450, 3456, 3462, 3468, 3474, 3480, 3486, 3492, 3498, 3504, 3510, 3516, 3522, 3528, 3534, 3540, 3546, 3552, 3558, 3564, 3570, 3576, 3582, 3588, 3594, 3600, 3606, 3612, 3618, 3624, 3630, 3636, 3642, 3648, 3654, 3660, 3666, 3672, 3678, 3684, 3690, 3696, 3702, 3708, 3714, 3720, 3726, 3732, 3738, 3744, 3750, 3756, 3762, 3768, 3774, 3780, 3786, 3792, 3798, 3804, 3810, 3816, 3822, 3828, 3834, 3840, 3846, 3852, 3858, 3864, 3870, 3876, 3882, 3888, 3894, 3900, 3906, 3912, 3918, 3924, 3930, 3936, 3942, 3948, 3954, 3960, 3966, 3972, 3978, 3984, 3990, 3996, 4002, 4008, 4014, 4020, 4026, 4032, 4038, 4044, 4050, 4056, 4062, 4068, 4074, 4080, 4086, 4092, 4098, 4104, 4110, 4116, 4122, 4128, 4134, 4140, 4146, 4152, 4158, 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How to Give Painted Furniture a Novel Parchment Finish

By LAWRENCE B. ROBBINS

BY MEANS of what is called a "parchment" finish, any home worker can produce novel, artistic and beautiful effects on painted furniture and other enameled surfaces.

The process is simple and inexpensive and can be accomplished successfully even



Mixing artists' colors of tube paints with turpentine and Japan on a clean piece of glass.

by the beginner. Such a finish closely resembles the stippled wall effects produced by interior decorators (see page 72, May issue) and has two advantages: it insures an interesting and pleasing appearance or texture, and it conceals any small blemishes in the surface.

Enamel the article to be decorated in the usual way, by giving it one or two

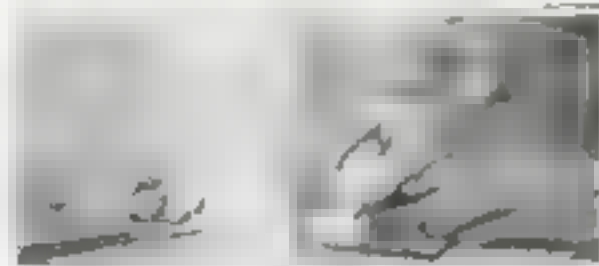


When thoroughly dry, the parchment finish is given a final coat of pale rubbing varnish.

coats of flat white or enamel undercoat, then the final enameling, either in one or two coats.

Now choose a color or colors to harmonize well with the enamel. These colors should be of the pigment variety in oil, known as artists' or decorators' colors, or tube paints. Make a paste by squeezing a sufficient amount on a piece of clean glass and thin slightly with turpentine. Mix well and blend the colors, if two are used, with a palette knife and add a few drops of Japan drier as a binder. The mixture should be about the consistency of thick house paint.

Ball up a small piece of cheesecloth into a little dauber and hold in the fingers of the right hand. Then, dipping it into



How the color is picked up on a cheesecloth dauber and then applied to the enameled surface.

the prepared color, tamp it lightly on the enameled surface, giving it a slight twisting motion at the same time. This will make a swirling daub of color on the enamel which can be regulated by the touch to be as delicate or bold, regular or irregular, as you please.

Allow the paint to dry hard and then give it a thin coat of pale rubbing varnish. Rub it down, if you desire, to a satiny finish with pumice and oil or water.

Spark Guard for Fireplace Made Like Window Screen



ON CHILLY spring days, when logs are set blazing in the fireplace, the sparks may be confined effectually with the screen illustrated above—one of the safest and easiest made. A frame of angle iron is made to fit the opening of the fireplace and covered with strong wire cloth. Then the iron is faced with sheet brass and a handle attached to either side. Two lengths of band iron extend in from the top of the frame and catch hook-like behind the top of the fireplace.—C. L. M.

The Home Workshop

Pie Plates and Bicycle Hub Form Toy Water Turbine

WHILE many boys try to build a small water motor with varying degrees of success, few realize how easily a really workable little turbine can be put together.

An old bicycle hub will provide a good ball bearing for the rotary member. To make the rotor, numerous evenly spaced cuts are made around the circumference of a thick circular disk. The resulting fins are twisted at right angles.

Two pie plates, aluminum preferred, are used as a housing. They are fastened together with stove bolts so that they can be taken apart readily if necessary. A $\frac{1}{4}$ in. pipe forms the nozzle. It is filed partially with lead after which it is drilled and reamed out as detailed, and cut at the proper angle to conform with the path of the rotor. It should be clamped between the pie plates with a clearance of $\frac{3}{4}$ in. from the rotor.

A hole for drainage is cut in the bottom of the housing and may be provided with a hose connection, if desired. A wooden pulley can be cut out roughly clamped



How the water motor is made and mounted



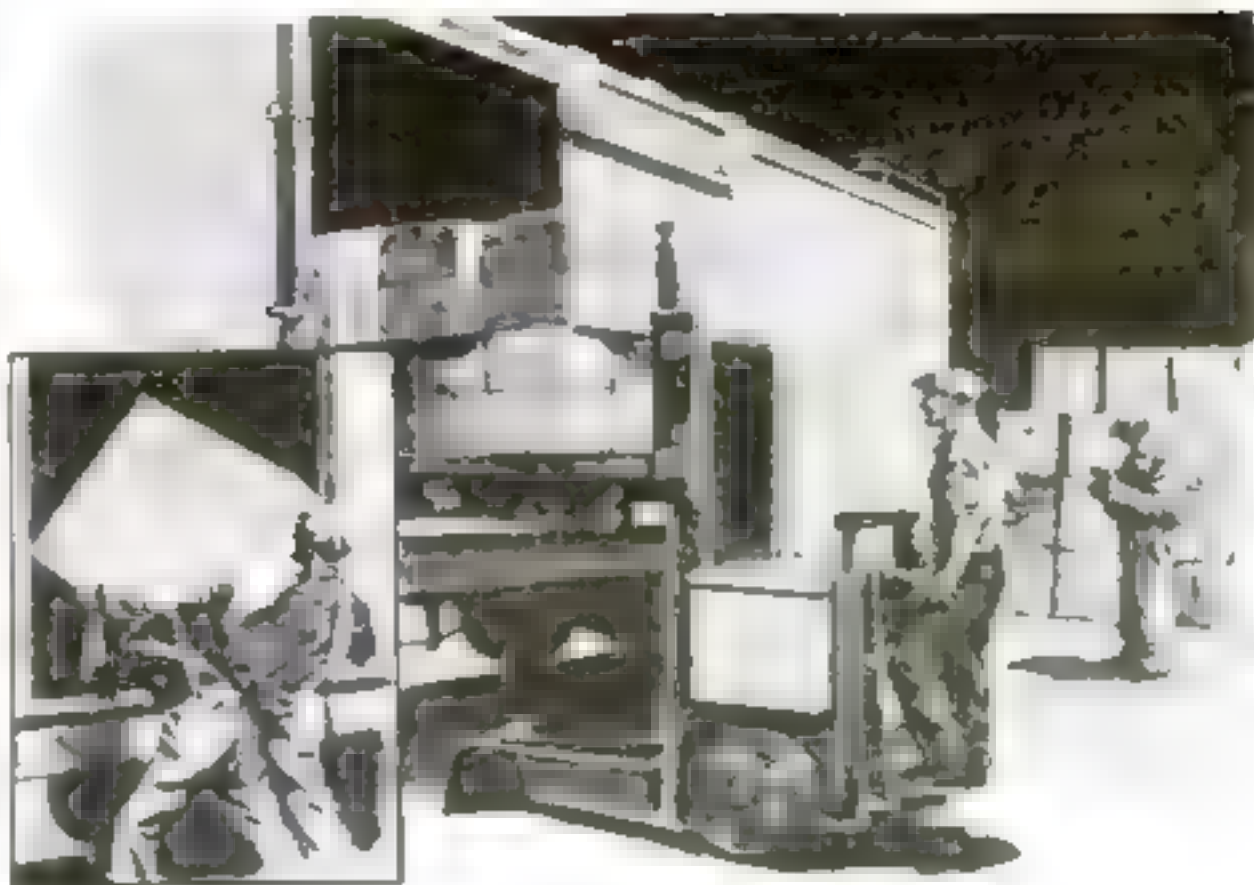
Water motor as shown here may be used for light jobs, such as grinding and buffing

in place, and turned down after connecting the turbine with the water system.

This turbine uses but little water and develops considerable power, if the average city water pressure is available. It can be used to run toys or, if well built, even light machinery or a buffer, emery wheel, polisher, or fan substituted.
JONAS J. BYBERG

Tricks in Using Sandpaper

MOISTENING the back of sandpaper with water makes it more flexible and insures a smoother surface on the work. Before the paper is moistened it usually is split at one corner and a thick layer of paper at the back is torn off. Another trick is to dip the abrasive side of sandpaper in a shallow dish of mineral or rubbing oil before sandpapering a varnished surface. This eliminates dust and gives a smooth finish but the oil must be well cleaned off afterward.



A turn of the switch now lifts or lowers heavy burdens anywhere.

If you ever had to lift a safe

Not being a truckman, you will probably never be called on to lift a barrel of sugar or an iron safe.

But if you were, you would be very glad that the "lift-truck" had been developed.

It is one of the great number of machines by which electricity is taking over the world's heavy burdens. If, as a certain large factory found, one of these little trucks saves \$12,000 a year, what a saving there will be when all material in all factories is handled by electricity!



The monogram of the General Electric Company is on many different types of motors, some small enough to wind a clock, some powerful enough to pull a train, but all designed to lessen men's labor and lower the cost. Look for it when you buy anything electrical.

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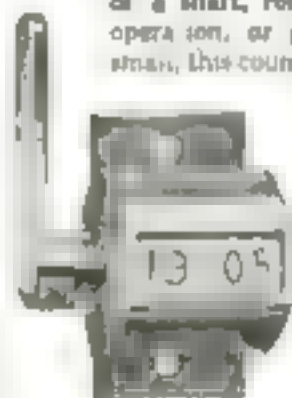
You look at the dial of a Veeder Counter for one main thing—you are looking for more production.

You are looking for figures of progress in machine development. You're looking for better or speedier operating.

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Veeder COUNTERS

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable.



its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines and most adaptable to experimental work. If run backward the counter subtracts.

Price \$2.00. Cut 4 5 size: Small Rotary Ratchet Counter to register reciprocating movements of small machines, also \$2.00.

The large Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Set back to zero from any figure by turning knob once around. Supplied with from four to ten figure-wheels, as required. Price with four figure-wheels as illustrated, \$0.00 subject to discount. Cut less than one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as on presses, \$1.50 (wt.).

FREE—We'll send you the big Veeder booklet. Shows counters for all machines and development-work.

The Veeder Mfg. Co.,
44 Sargeant St. Hartford, Conn.

The Shipshape Home



Patching Broken Cement Work

How to Make Lasting Repairs to Concrete Walls and Walks



By DALE R. VAN HORN

YOU do not need to be a skilled workman to use cement in making repairs about the house and garden. There are only a few things required to insure a satisfactory job. These are:

Get a good grade of cement.

Be sure the aggregate, that is, the sand and gravel, or the sand, gravel and crushed rock or cinders, is clean and free from organic matter or clay. If you are not sure of the materials, especially the sand, place a small quantity in clean water, then stir it up well. If the water remains fairly clean, the sand or other aggregate is fit for use. Too muddy water indicates impure materials.

If you are to undertake a repair job, be sure that the old surface is clean to insure a perfect bond. This may take some scrubbing with water, but it is imperative.

The only equipment you will need is a small mixing box, a pail or two, a hoe of some kind—a rusty old garden hoe will do—and preferably two trowels. One of these should be a plasterer's trowel of rectangular shape, and the other should be of triangular shape, of the kind used by bricklayers.

To repair a break in a sidewalk, carefully remove any broken fragments of concrete and with warm water and a stiff brush scrub the broken surface until every vestige of loose material has been removed. Let the water soak well into the old concrete, so that it will not dry out too soon.

If the surface is not rough and jagged, roughen it with a cold chisel and a hammer.

Mix your cement mortar in the propor-

tions of one part cement, two parts sand, and three parts gravel or other aggregate, or for a small job, merely mix one part of cement with three parts of sand.

The trick in preparing cement properly is to measure and dump the sand and gravel or other aggregate in the box, mix them thoroughly with shovel or hoe, spread the mixture out and then add the cement. Turn over the material dry at least four times. Add water slowly and continue mixing until the desired consistency is reached—"quakey" but not too wet.

Build up the broken place until the top and sides are in line with the old walk. This done, sprinkle a little pure cement upon the wet surface and trowel down.

If the work is done in very hot weather sprinkle some sand over the repair and cover with a wet rag, which should be kept moistened for several days until the new concrete has set thoroughly. If these precautions are carried out, the bond should be perfect.

The basement walls about the average home often crack or settle in different places, thus letting water through during wet weather and sometimes cold air during the winter. A good afternoon's job is to go over the walls carefully and check any holes you may find.

Wherever there is a crack, spray water on the concrete for several minutes, letting it soak in well. Then check the hole with a

(Continued on page 97.)



Wet and clean the old work (above) and apply the new cement neatly with a trowel

The Shipshape Home

Patching Broken Cement Work

(Continued from page 96)



Sprinkle a little pure cement upon the wet surface and trowel the patch to a smooth finish.

rich mortar, preferably with a small amount of lime mixed in, and finish off with a small trowel.

If the sidewalk is near by, you need not bother with the mixing box, but can work up the cement, sand and water on the sidewalk. Be sure to raise off the walk before the residue of cement has time to set.

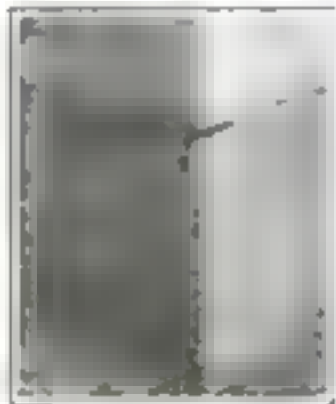
Every brick chimney should be capped with cement either cast directly in place or made upon the ground to suit the dimensions of the chimney.

The lower photograph on page 96 shows such a chimney cap, which has been used ten years without visible sign of weakness.

To repair a chimney in this way, remove all loose bricks, clean the surfaces and cement them back with a mixture of equal parts of cement, lime and two parts screened sand. Then cut four boards of such a size that, when nailed together, they will hold in place at the chimney top. Each board should extend 4 in. above the top. A similar form should be built and set in place inside the line. It is then merely a matter of filling between the boards with cement, mixed in the proportion of one part cement and two parts of sand or gravel. It will be well to insert heavy wire or rods at the corners for reinforcing.

Some concrete jobs prove unsatisfactory because of a slight oversight. Here are a few reasons for the failure of concrete work.

Checks and cracks, which often occur in sidewalks, are either due to poor cement, uneven materials, a poor bed, or the action of the



Lack of reinforcement caused this crack in a foundation wall, but it can be easily patched.



Outshines Them All!

The Star Special Flexible Blade was presented to the American market some few months back as the latest development of a perfected flexible blade.

The makers, Clemson Bros., Inc., of Middletown, New York, introduced the famous all hard Star Blade forty-two years ago.

This blade outshines them all when cutting soft metals, heavy tin sheets, angles, pipe, conduit, etc.

"Makers Since 1883"

Let us send you samples of the blade Free

STAR HACK SAW BLADES

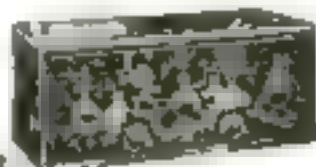
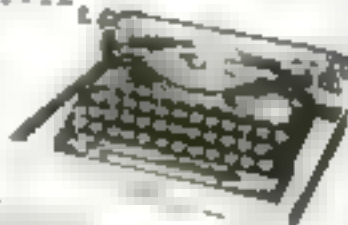
Clemson Bros., Inc.

Middletown, N. Y.

Own a CORONA

The world's most popular typewriter. It is the machine that has made the business man's life easier and his work more efficient. It is the machine that has made the home life more comfortable and the school life more interesting.

Corona Typewriter Co., Inc.
125 Main Street, New York, N. Y.



This

R.F.L. 60 at \$60

is the answer to Powell Crosley, Jr.'s demand on his engineers for a more perfect 5 tube receiver that would give maximum range, selectivity and volume at lower cost.

CROSLEY RADIO

Write Dept. 17 for Brochure
THE CROSLEY RADIO CORP.
Cincinnati, Ohio
Prices slightly higher west of the Rockies
Dealers sell Crosley Radios from \$29.95 to \$75. and the Musicking Loudspeaker at \$14.95

A new Parks! Cabinet Shop Special

No. 10
\$290



Make a real shop in your basement

This handy Parks woodworker is complete shop equipment in itself. With it you can do all sorts of cabinet work. Make toys, picture racks, bookshelves, anything. Built to do all sorts of work too small enough to fit in a corner. A year in basement. Operates from both sides. Has a rip and cut off circular saw, joint and square. Add lathe and shaper at slight extra cost. A real machine ideal for home use. Send for circular.

The Parks Ball Bearing Machine Co.
1547 Knowlton St., Cincinnati, Ohio
Canadian Factory: 230 Notre Dame East, Montreal, Canada

PARKS
WOODWORKING MACHINES

The Shipshape Home

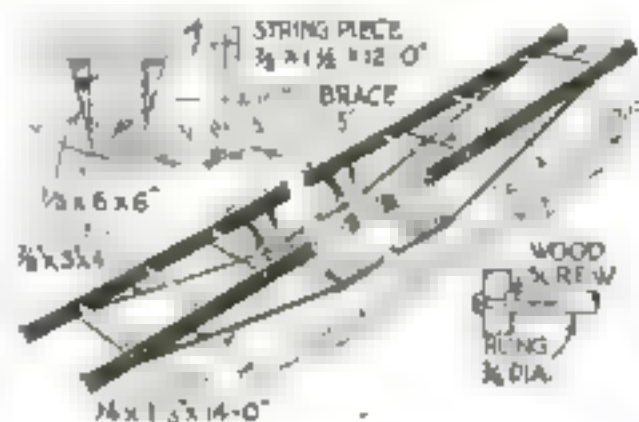
(Continued from page 98)

Ladder for House Repairs

A LIGHT 12-ft. ladder for general purposes around the house and yard was required on short notice. To meet the need, the trussed ladder shown in the accompanying drawing was constructed from materials found in the basement.

A piece of 8-in. wide yellow pine flooring was ripped to form the two sidepieces of the ladder, each $7\frac{1}{2}$ by $1\frac{1}{2}$ in. by 12 ft. A piece of straight-grained oak from the wood pile furnished the rungs.

The chords or tension members of the truss were made from some cypress lattice



Lightness is the feature of this well braced ladder for general use around the house

strips, while odds and ends of lumber furnished the smaller pieces required. The only things purchased were the few tie rods or lag screw bolts, which were placed just beneath four of the rungs to hold together the string pieces.

A good tension was secured on the chords by giving a slight camber to the ladder. The ladder weighs only 25 lbs., and if white pine or other light wood had been available, it would have weighed even less. **HENRY JEWEL**

How to Keep Paintbrushes

I am using today paintbrushes that are six years old and in perfect condition. This is how I keep them.

An oil-tight tin with a lid is obtained and two slots are cut with a chisel in the lid to suit the size of the brush handle. The vice jaws serve as a spacer under the lid while the slots are being cut. Another cut is made connecting the first two at their center points, and the resulting flaps are bent under.

A hole is bored through the handle of the brush to take a small nail, and enough raw linseed oil poured in the can to cover the bristles. The lid prevents the oil from drying out quickly. I keep two small brushes in one can; each of the larger brushes is in its own. —**ERIC B. ROBERTS**



Brush containers

SPIRAL SPRING arm bands that part at the joint can be repaired by sweating the ends together with a drop of solder.

SIMONDS

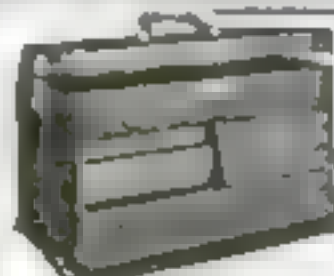
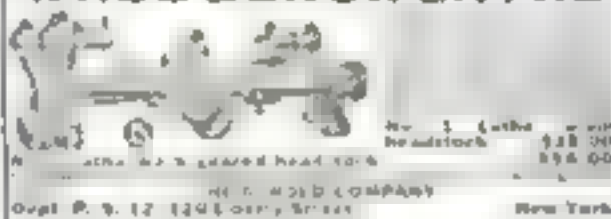
KEEP THIS SAW SHARP



FROM teeth to temper, every important point about a Simonds Saw or File reflects Simonds' near-century experience in making the finest cutting steel. It pays to specify "Simonds" when buying

SIMONDS SAW AND STEEL COMPANY
The Saw Makers
Established 1892

WADE BENCH LATHE



TOOL CHESTS FOR PARTICULAR MEN

FREE CATALOG

Send for it TODAY!
H. GENSTER & SONS
320 Columbia St., Des Moines, Ia.

AMPLION

Product of nearly 40 years' experience



Clear natural tone, broad musical range and supreme sensitivity distinguish the Amplion from other loud speakers. Your set will perform only as well as the loud speaker will reproduce. Your good set deserves the best loud speaker you can buy. Try an Amplion for an evening or two. You will bear your set at its best with an Amplion.

THE AMPLION CORPORATION OF AMERICA

Suite M, 220 Madison Avenue, New York
Chicago Branch: 179 North Morgan St.
Amplion Corporation of Canada Ltd., Toronto



16 in. to 24 in. swing over bed
New cutting lathe

New Lathe Catalog Free!

Shows 96 styles and sizes from the smallest Bench Lathe to the largest Factory Production Lathe. Describe

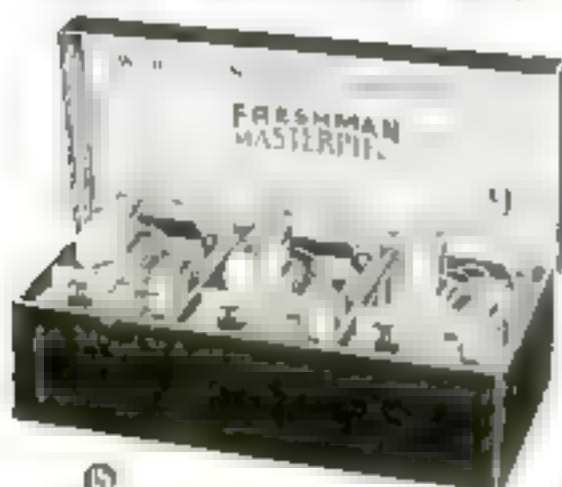
The New South Bend Lathe

shows 96 styles and sizes from the smallest Bench Lathe to the largest Factory Production Lathe. Describe

South Bend Lathe Works
875 East Madison St., South Bend, Ind.

It's Easy to Build a Powerful Set

Using the New and Improved FRESHMAN "TRF" Low Loss Kit



Straight Line Wave Length Condensers With Low Loss Self Balanced Coils

These are the identical units which have made the FRESHMAN MASTERPIECE factory built Receivers the World's Greatest Radio Sets.

Complete instructions for building this powerful five tube receiver, written in plain everyday English, together with actual size schematic wiring diagram, are furnished with every FRESHMAN "TRF" Kit.

Made for you by the best of materials and workmanship.

CHAS. FRESHMAN CO., Inc.
Freshman Building, New York
2020 W. Washington Blvd., Chicago

Old Bill Says—

THE cautious man looks both ways when crossing a street; go him one better and look four ways at your drawing of blueprints.

Many draftsmen could improve their work and add to their knowledge by getting better acquainted with the shop men.

More cooperation is needed between the shop and the drafting room.

What we want in the shop is teamwork and plenty of it—the same thing that makes a baseball team win games.

I would like to run my shop like a baseball game, and make every move count for something.

Any mechanic can make himself more valuable and can get more pleasure out of his work by taking a study course in drawing.

If a belt has wire lacing, never use your bare hands to make a speed shift; wire lace has caused many a painful cut.

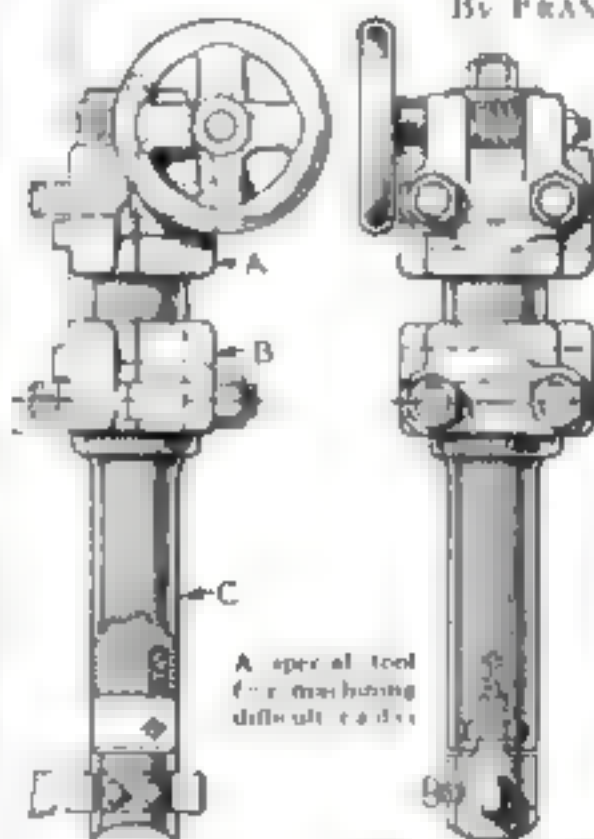
There is a right way to use a monkey wrench. The jaw opening should point in the direction of the pull.



Old Bill, machine shop foreman

A Rotating Tool Holder for the Slotter

By FRANK N. COAKLEY



A special tool for machining difficult radii

FOR machining a radius that could not be done in the usual way, either on the slotter or boring mill, the tool illustrated was developed to do the job on the slotter.

The two bearings A and B are castings accurately bored to fit the bar C and provided with tongues to match the slotter head to which they are held by studs. The tool bar is made of round stock and has a tool holder at the bottom end, hinged to give relief on the up stroke. A small spring returns the tool holder to working position.

A worm wheel is keyed to the upper end of C and is held in place by a stud and nut, which are adjusted so that all end motion is taken up.

A handwheel or crank is used for the feed, which is by hand. Dimensions necessarily have to be adapted to the machine and to the work in hand.

Cutting Off Metal Strips Quickly in a Shaper

WHEN a punch press is not available, the method illustrated below may be used for cutting off strips of steel, brass, copper, aluminum or other material in a shaper economically and quickly.

Two parallels reversed. One has a longitudinal recess planned in it to correspond with the width and thickness of the metal. A hardened tool steel plate is fastened on the end with two flange head screws and dowel pins to form a cutting edge. The second parallel is



The stock is fed through a guide and is cut off against the edge of a hardened steel plate



simply to keep the metal firmly in place. The depth of the recess in the guide should be slightly greater than the thickness of the metal, so that it will slide through freely. An adjustable rod projects from a hole in one end of the parallel and has a sliding collar, which can be set as a stop wherever desired.

The shaper tool is made with a blade of rectangular section and is ground with side rake only. It is set up to the shear plate with a piece of paper.

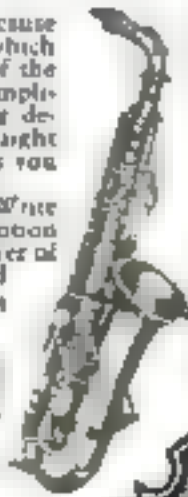
In use, the shaper is kept running continuously while the operator feeds the metal through the guide and against the stop. —H. L. W.

Conn's Exclusive features make playing easier

You learn quickly with a Conn because of the patented improvements which make these instruments choice of the world's great artists. Improved simplified key system, patented tuning device, Conn tail valve on sax, straight mouthpiece are all Conn features you should have for they cost no more.

Free Trial, Easy Payments. Write now for Free Book and details. Mention instrument Conn is the only maker of every instrument used in the band.

CONN
BAND
INSTRUMENTS



A Masterpiece of Tinycraft

(Continued from page 55)

the center archway of the minstrels' gallery, flanked by Chinese vases of blue, all in the most exquisite miniature. The parquet floor contains 2,000 tiny pieces inlaid with marvelous patience by a retired colonel, living in Switzerland, who has been delighted to contribute to Sir Neville's unique palace. Tall bronze doors open into the courtyard, while a screen of lacelike jade conceals another door leading into the chapel.

Here is a room of almost breathless delight. On the pure white marble floor stand bronze Biblical groups. A ceiling of mosaic, archangels, attended by the morning stars, standing poised on a crystal sphere, looks down on this beautiful chapel.

A SECRET panel at one side of the chapel admits to the Queen's boudoir. In this room is a tiny grand piano that is worth a story in itself. There are a Louis XV bureau and an ivory spinning wheel. Tiny canes in tortoise-shell frames decorate the walls. A door of dark Domingo mahogany leads to the state dining room.

In this room is a walnut dining table just two inches high with two serving tables of the same height. Dainty dishes of old Bristol ware rest on clothes of gossamerlike lace from Jerusalem. Landscapes painted in Holland 300 years ago for the doll's house of a royal nursery hang on the gray walls.

In the morning room just beyond, you see a bureau in red lacquer only four inches high, perfect in every detail, its tiniest drawer dovetailed and lined with pencil cedar.

Beyond the morning room is the hall of the guests from which we started, with its visitor's book lying beside the cannon. This volume, bound in exquisitely tooled leather, has pages less than an inch and a quarter square. One of the signatures in it is that of Mary, Queen of England.

THE grand staircases in the hall of the guests take us to the upstairs rooms. In the Fairy Queen's bedroom the state bed will catch your eye at once. It is a marvelous canopied couch ten inches high, with five golden pillars, and with an ivory alay in its golden lacquer.

Next to the bedroom is the bathroom, but there are no taps and drains in the bathtub. Sir Neville explains that the marble bath is filled with dewdrops.

The nursery is also on the second floor. This is the home of little Prince Crystal, whose toys from China, Bavaria, Switzerland and England litter the floor.

The apartments of Oberon, King of the Fairies, are the last on this floor. His fello, his chessmen and his Pekinese dog, Prince Chung, adorn the study. He has, too, a museum which is already full to overflowing with treasures from the Far East and from Italy. It includes, incidentally, what is probably the finest collection of miniature Bristol glass to be found anywhere in the world.

These are only a few of the remarkable items in the amazing equipment of this unique and beautiful palace as it begins its first world tour.

This Ornamental Trellis Work Will Add Charm to Your House or Garden

BEAUTIFUL as this trellis is, it is surprisingly easy to build and well within the ability of any man handy with woodworking tools. And the construction is sturdy enough to insure the trellis lasting for years.

Ornamental trellis-work like the one illustrated, to-



gether with other designs for trellis-work, are available in the HomeWorkshop Blueprint No. 34.

Architects often use well designed and carefully placed trellises to give an added attraction to poorly proportioned houses.

Full working details and building material for trellises such as pictured in this advertisement are contained in Blueprint No. 34 which will be sent you by return mail on receipt of 25c.

POPULAR SCIENCE
MONTHLY

250 Fourth Avenue
New York, N. Y.

MAIL TODAY

I am enclosing 25c for which please send my Blueprint No. 34 of the Arbor, Lute and Swing.

Name

Street

City and State

Don't Be a Slave

BEISSER KEY MACHINE

You can start a business of your own, no experience necessary. Only machine that will make \$100 a week for you. Write today for full particulars.

BEISSER KEY MACHINE CO.
404 East Street East, Detroit, Michigan

STICKS TO IRON OR STEEL

NEW KIND OF TROUBLE LAMP

\$200 A WEEK EASY FOR SALESMEN!

This new kind of auto trouble lamp with magnetic base sticks to any iron or steel part of automobile at any angle—even upside down. Reaches any part of car. Leaves both hands free to work. Also powerful spot and floodlight. This is needed for night driving and touring. Price \$14.95. 34 to 60 seconds on any car. No other auto lamp costing \$1.50 to \$15.00 can be so easily and quickly attached. Be sure you get the only one made. No other model. No wonder Tippet, Merrill, Clark, McHenry and Dwyer each keep standing orders for 500. Stock-a-lit in a month. Orders made \$14.95 to \$19.95 a week.

MAKE FREE TEST

Test \$14.95 (plus without cost. Just hurry for big business season. Send \$2.00 deposit for demonstrator. This will be refunded if demonstrator is returned in 30 days. If you wish send no money—just send for details. But act at once as this can mean \$200 a week for you. And our evening will prove it.

PREMIER ELECTRIC CO.
1831 Grace Street, Dept. G-111, Chicago, Illinois

"LIGHTING FIXTURES"

Ready to hang.
Direct from the manufacturer,
Completely wired, including
glassware.
Send for New Catalogue No. 27
(Just reduced prices)
Special preparation to Dealers
ERIE FIXTURE SUPPLY CO.
Desk A, Erie, Pa.

GROSLEY

\$14.75

MUSICONES

because of their natural reproduction of voice music and beauty are replacing thousands of loud-speakers.

Write Dept. 17 for Booklet

Prices slightly higher west of the Rockies

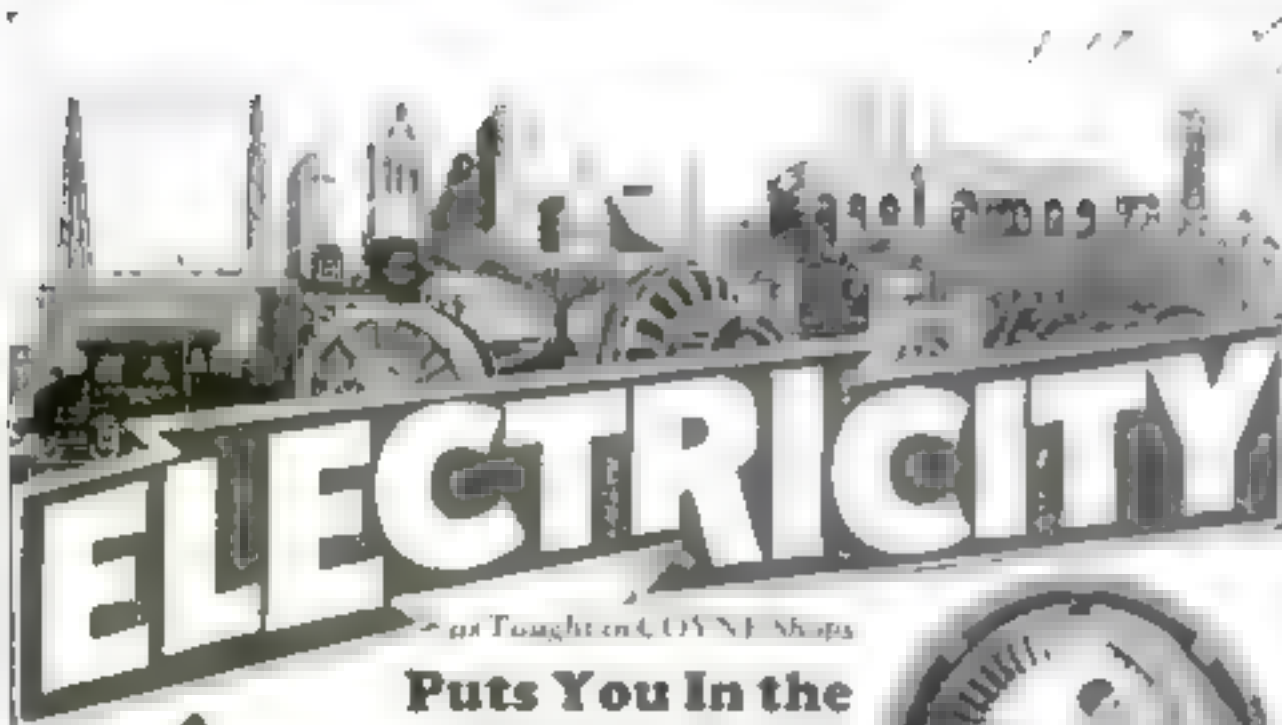
THE GROSLEY RADIO CORP.
Cincinnati, Ohio

Crosley Radios \$9.95 to \$75

Money Making Opportunities

for Readers of Popular Science Monthly

RAILROAD FARE TO CHICAGO
Included Without Extra Cost If You Are RIGHT AWAY!



as Taught in COYNE Shops
**Puts You In the
Big-Pay Class
Quickly!**

HUNDREDS OF
COYNE-TRAINED
MEN EARN
\$60 to \$100
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TRAINING**

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Electrical Course is the
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Our new system of training
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**We Teach Electricity and
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COYNE teaches only ONE thing
ELECTRICITY. We are SPECIALISTS.
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You Can Start Any Day of
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Every COYNE student
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ELECTRICITY. This book
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ELECTRICITY. It is the
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Send for Big FREE Book!
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my big, new, FREE
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most practical and
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complete course in the
subject of ELECTRICITY.
It is the most practical
and thorough course in
the country.



**Earn While
You Learn
at COYNE**



SEND COUPON NOW

H. C. LEWIS, President
COYNE ELECTRICAL SCHOOL
1340-10 W. Harrison St.
Dept. A-136 Chicago, Illinois

Thank you for sending me a copy of
your book on the subject of
ELECTRICITY. I am interested in
learning more about it. Please
send me a copy of your book.

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Address

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ELECTRICAL SCHOOL**

H. C. LEWIS, President Established 1910
1340-10 W. Harrison St. Dept. A-136 Chicago

There is no Substitute for Personal Training, in
Great Shops, on COMPLETE Apparatus

Prize Winners in the April Contest

(Continued from page 112)

The first prize of \$50 this month goes to Donald Henkle of Paris, New York, who tells a very human story of the success he won as a result of taking the complete course of the Michigan State Automobile School. Mr. Henkle says:

Content Editor:

An OPPORTUNITY, what is an opportunity? What do most people do when they get one? Let it slip by and wait for a better one. That is a majority of people do.

I always do not! About two years ago I got tired of drifting and getting nowhere (in)

(Continued on page 112)

\$100 in CASH PRIZES

For the best letter of 150
words or less answering
the question—

*"What advertisement in
the 'Money-Making Op-
portunities' Section inter-
ests you most—and why?"*

we will pay on July 10th
the following—

CASH PRIZES

First Prize	\$50.00
Second Prize	25.00
Third Prize	10.00
Fifteen Prizes of \$1.00 each	15.00

First read every advertisement
in the Money-Making Oppor-
tunities Section on pages 110 to
135. Pick out the one that in-
terests you most and then write
a letter—not exceeding 170 words
—telling us why you find the
advertisement you have selected
the most interesting.

Entries for the contest will
close on June 1st. The prize
winners and their letters will be
published in the August issue of
POPULAR SCIENCE MONTHLY.

Address your letter to
Contest Editor

MONEY-MAKING OPPORTUNITIES
POPULAR SCIENCE MONTHLY
250 Fourth Ave., New York

State

Prize Winners in the April Contest

(Continued from page 112)

follow in the wake of a trained mind. The smiling front of ignorance is sure to be de-heated and dethroned when knowledge enters. For my part I consider this great institution as one of America's greatest benefactors simply because they are shaping the pulse beats of the business world.

Yours very truly,

W. W. WILKERSON

There are just as big opportunities today as there were when these men saw the signpost to success and followed it. Read the offerings of the advertisers on pages 110 to 113. Pick out those that interest you most, write for details of their offer and decide which road you will use to achieve success.

Complete List of PRIZE WINNERS in the April Contest

FIRST PRIZE \$50

Donald Henkle, Paris, N. Y.
(Michigan State Automobile School)

SECOND PRIZE \$25

C. L. Nelson, Academy, S. C.
(Theo. Audel & Co.)
(International Correspondence Schools)

THIRD PRIZE \$10

Rev. W. W. Wilkerson, Deming, N. M.
(National Salesmen's Training Association)

PRIZE WINNERS who receive \$1.00 each for their letters:

Harold V. Bralder, Lima, Ohio
Victor J. Evans Co.
W. Spofforth St. Paul, Minn.
International Correspondence Schools
Beahm Jauer, Rosebud, Texas
(National Salesmen's Training Assn.)
Charles T. Sharpe, Los Angeles, Calif.
(American School of Chicago)
Donald B. Templeton, New York, N. Y.
American School
National Radio Institute
Otto Hansen, Los Angeles, Calif.
International Correspondence Schools
R. M. Prinz, Kansas City, Mo.
(Coyne Electrical School)
Evert Myers, Parkersburg, W. Va.
U. S. School of Music
R. Melrose, St. John, N. B., Canada
American Photography
Maurice W. Hykes, Emporium, Pa.
(International Correspondence Schools)
C. R. Bangen, Crookston, Minn.
(The Patz Root Heath Co.)
J. E. Kurlhar, Cleveland, Ohio
(U. S. School of Music)
Mary G. Wilson, Hollis, Ala.
(Franklin Institute)
W. J. Stromberg, Jersey City, N. J.
(Stephenson Laboratory)
R. W. Carr, Parkersburg, W. Va.
National Salesmen's Training Assn.

No Wonder \$66^a day is Easy



27,000,000 readers of National Magazines are waiting to buy this astonishing invention from YOU! It is never sold through stores. Start cashing in now—while the name "KRISS-KROSS" is on every tongue!

When You Show Men This Amazing New Way to Shave!

Marvelous New Invention Offers Almost Unbelievable Opportunity to Make Big Money! KRISS-KROSS Salesmen Everywhere Are Cleaning Up \$30 to \$70 a Day with Clocklike Regularity. Read Every Line of This Announcement Which Offers You the Biggest Money of Your Life!

I DON'T care who you are, you never had a chance to make money like this before. The KRISS-KROSS man has swept the country like wildfire. Even professional men (doctors, lawyers, etc.) have left their regular work to get their share of the tremendous profits being reaped by demonstrators of this revolutionary shaving invention. Unless you are making over \$400 a month, you are simply cheating yourself if you pass up this opportunity to put away \$40 to \$400 cash profit every 30 days!

What Is It?

KRISS-KROSS—the magic self-seller—is a super-stripper or blade-rejuvenator. It is showing millions of men an amazing new way to shave without buying new blades. Unlike anything ever placed on the market before, this astonishing invention prolongs the life of any make blade for weeks, months, and even years! Its mechanical ingenuity is little short of marvelous. It strips with a diagonal stroke, just like a master barber, but with an unvarying accuracy no human being can ever attain. Light, lucky, better growses do the trick in 11 seconds and leave your blade with the keenest edge that steel can take!

KRISS-KROSS also strips from heavy to light, handling up with those easy delicate strokes that are the secret of 100% sharpness.

Give Men a Mystery Gift Razor Free!

Our unique selling plan makes everything easy as ABC for you. That's why KRISS-KROSS men make such startling profits so easily. One of the greatest helps we give you is a brand new kind of razor

that you offer FREE to every man you meet. Just think what a wonderful opening that gives you! This unusual razor is really 3 razors in one! It is instantly adjustable—straight, T-shape, or diagonal. Its new feature cuts beard resistance 45%, and gives the smoothest shaves you can imagine. As an attention-getter and sales-maker, this KRISS-KROSS razor has never had an equal in the history of shaving!

Read What These Men Say:

And remember, this razor is so popular in the world, why should you not be back at work with KRISS-KROSS?

\$44 a Day

I sold 100 in 10 days, my whole day's work. I sold 10 more in the next 10 days, and made \$44 in 20 days, working only 10 hours. I got \$100 in 30 days.

\$44 in 10 minutes

I sold 100 in 10 minutes, my whole day's work. I sold 10 more in the next 10 minutes, and made \$44 in 20 minutes, working only 10 minutes.

\$700 a Week

I sold 100 in 10 days, my whole day's work. I sold 10 more in the next 10 days, and made \$700 in 20 days, working only 10 hours.

\$44 a Day

I made \$44 a day, giving a KRISS-KROSS razor to every man I met. I sold 100 in 10 days, my whole day's work.

FREE \$5,000 Sales Manual Shows Exactly How to Sell

And now, in addition to advertising in all the big magazines, we are going still farther to help you make big money with KRISS-KROSS. At an expense of \$5,000, we have prepared a brand-new sales manual the equivalent of a \$100 per man in salesmen's help. This remarkable little book tells you exactly how to sell KRISS-KROSS—what to do and say; how to approach a customer; how to gain his attention; how to answer every possible question he can ask; how to get the money in your pocket. This KRISS-KROSS book will sell for \$100, could easily sell for \$2. We give it to you FREE!

Get Started at Once

Right now, a lot of men are reaping big profits with KRISS-KROSS. If you are a man of business, you must get in the way for you to get the big profits. If you are a man of business, you must get in the way for you to get the big profits. If you are a man of business, you must get in the way for you to get the big profits.

RHODES MFG. CO.

Dept. C-240, 3418 Pendleton Ave., St. Louis - - - - - Missouri

Rhodes Mfg. Co., Dept. C-240, 3418 Pendleton Ave., St. Louis, Mo.

Please send me all details of your nationally advertised KRISS-KROSS razor, and explain your terms and prices. I am ready to make big money giving away KRISS-KROSS razors FREE.

Name _____

Address _____

City _____ State _____

Rhodes KRISS KROSS STROPPER

Quick Action Advertising

ADDING MACHINES

For sale, a new, high speed, adding machine, with all the latest improvements. It is a real money maker. Price, \$100.00. Call for details.

ADVERTISING SERVICES

Advertising services for all businesses. We will design and place your advertisement in the best possible manner. Our rates are low and our results are high. Call for a free estimate.

ALL HORNS AND MANUSCRIPTS

We buy and sell all horns and manuscripts. We have a large stock of horns and manuscripts for sale. We also buy and sell all kinds of musical instruments. Call for details.

A FURNITURES AND ACCESSORIES

Furniture and accessories for all homes. We have a large stock of furniture and accessories for sale. We also buy and sell all kinds of household goods. Call for details.

ASSETS

Assets for sale. We have a large stock of assets for sale. We also buy and sell all kinds of property. Call for details.

BOATS AND LAUNCHES

Boats and launches for sale. We have a large stock of boats and launches for sale. We also buy and sell all kinds of boats. Call for details.

Rate 10 Cents a Word, A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the July, 1926 issue should be received by June 15th

BOATS AND LAUNCHES

Boats and launches for sale. We have a large stock of boats and launches for sale. We also buy and sell all kinds of boats. Call for details.

BLUE PRINTS

Blue prints for sale. We have a large stock of blue prints for sale. We also buy and sell all kinds of blue prints. Call for details.

BOOKS AND PERIODICALS

Books and periodicals for sale. We have a large stock of books and periodicals for sale. We also buy and sell all kinds of books. Call for details.

BUSINESS OPPORTUNITIES

Business opportunities for sale. We have a large stock of business opportunities for sale. We also buy and sell all kinds of business opportunities. Call for details.

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BUSINESS SERVICES

Business services for sale. We have a large stock of business services for sale. We also buy and sell all kinds of business services. Call for details.

CHINA TABLES

China tables for sale. We have a large stock of china tables for sale. We also buy and sell all kinds of china tables. Call for details.

DISTRICT MANAGERS AND REPRESENTATIVES WANTED

District managers and representatives wanted. We have a large stock of district managers and representatives for sale. We also buy and sell all kinds of district managers. Call for details.

EDUCATION

Education for sale. We have a large stock of education for sale. We also buy and sell all kinds of education. Call for details.

EDUCATION AND INSTRUCTION

Education and instruction for sale. We have a large stock of education and instruction for sale. We also buy and sell all kinds of education. Call for details.

FINANCING AND INVESTMENTS

Financing and investments for sale. We have a large stock of financing and investments for sale. We also buy and sell all kinds of financing. Call for details.

FORMULAS

Formulas for sale. We have a large stock of formulas for sale. We also buy and sell all kinds of formulas. Call for details.

FOR BOYS

For boys for sale. We have a large stock of for boys for sale. We also buy and sell all kinds of for boys. Call for details.

FOR INVESTORS

INVENTOR: Universal Educator - no less 500
 mechanical movements of perpetual motions. Tells
 how to obtain and use the only bugger - new ideas
 explains how to select, use, affirm and hold the
 stuffs. After tested with me, I (Wendell Albert)
 in London 1811 (Wendell Washington D.C.)

SPATENTED Item can be sold I will not have
and help you make the sale Free partnership
Right into World W I Learning MAX Jester Building
Washington D C

INVENTIONS: Registered, Patented or un-
patented. Write Adams Fisher & Co. 150 Knight St.
Louis, Mo.

PATIENTS try to in "normal" free personal
and the Frank T. Miller Washington D.C.

BFIL also placed its agents in place. While for any three plans, Free Security 44 Central etc. longer than

INVENTOR HAS THE DISCOVERIES "What to In-
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asked for by customers. He's a free person for an
inventor. By the way, no patenting. He's a free

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BOOK MEN AND WOMEN

1417 1/2 W. 14th Ave. Apt. 1014
 Milwaukee, Wis. 53233
 Phone 442-1111 or 442-1112

123 of this design was fabricated by Thermal Company 40-2
Harris Street, Stoughton, Mass.

1. All NIP tubing (from existing records) of 1/2" type 44 standard tube, 354. 1 A Turn. 44 Section 11. 1000 ft. 1000 ft.

Wash. State Highway Bank, 800 Broadway, Seattle, Wash.
 2nd National Bank, 1st National Bank, 1st National Bank, 1st National Bank

FOR SALE

1. Full name (last, first, middle initial)
 2. Address (street, city, state, zip)
 3. Phone number (home or office)
 4. Business or school affiliation
 5. Signature
 6. Date

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PH: 310-333-1111 or using a letter to the publisher in California. And the developer to provide a letter to the publisher to be used in the future.

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FROM THE HOME

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THE UNIVERSITY OF CHICAGO PRESS

1. The first of these is the fact that the United States is a country of the United Nations. As a member of the United Nations, the United States has a responsibility to the United Nations to contribute to the maintenance of international peace and security. This responsibility is not only a moral one, but also a legal one. The United States is a member of the United Nations, and as such, it is bound by the Charter of the United Nations, which is the legal basis for the United Nations' actions.

HELP WANTED

H T S - 087965 Sileneo French plant I do not know
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The following information was obtained from the records of the [redacted] Department of the [redacted] State of [redacted] and is being furnished to you for your information.

1. Life policy a day needs \$10 per month profit.
 Permanent Income from premium for Special Policy
 pay \$2400 a mo. and \$5 weekly benefit for 40 yrs.
 if you or someone Premium \$9 ea. 21g dividend
 Free to sell to anyone by Mail plan. We equip
 in territory Underwriters 444 Broad St. Newark.
 N.J.

HELP WANTED INSTRUCTION

| | | |
|-------------|------------------|--------------------|
| INTERVIEWED | Sam B. Mohr | Taxident operation |
| From | Washington, D.C. | Specialist in |
| Address | White House | George W. Bush |
| Phone | 202-456-1111 | Further Government |

1. **Имя:** [Имя]

BY THE WHOLE FINEST COMEDY AND THE MOST
OF THE MOST FINEST COMEDY AND THE MOST

[illegible]

HOW TO ENTERTAIN

Mr. & Mrs. Charles E. Smith, 1000 N. 1st St., Chicago, Ill., are the parents of a son, Charles E. Smith, born Jan. 1, 1910, at Chicago, Ill.

INCORPORATIONS

D. LAWRENCE Incorporated 4 1/2 cns. First small
forms : 100. G. Guter Vol Orange 26. Wilmington,
Delaware.

[illegible]

CLERKS AND AGENTS WANTED

The first of these is the fact that the company has a long history of success in the market. It has been a leader in the industry for many years, and its products are well-known and respected. This is a testament to the quality and reliability of the company's offerings.

22. The 15. x large pigments with head
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4.1. *Staphylococcus aureus* (ATCC 12228) was grown in tryptic soy broth (TSB) (Difco) supplemented with 0.5% yeast extract (Difco) and 0.5% glucose (Difco) at 37°C. Cells were harvested at mid-log phase (OD₆₀₀ = 0.5) and washed with phosphate buffered saline (PBS) (pH 7.4) containing 0.1% bovine serum albumin (BSA) (Sigma) and 0.05% EDTA (Difco). Cells were then resuspended in PBS containing 0.1% BSA and 0.05% EDTA.

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4. The following information is being furnished to you for your information:

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1. The first step is to identify the problem. This involves understanding the current situation and the goals that need to be achieved.

4. The following information was obtained from the records of the Bureau of the Census, Department of Commerce, for the years 1964 through 1968:

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1. Mr. J. Edgar Hoover, Director, Federal Bureau of Investigation, Washington, D. C.

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1. История - это наука о прошлом, о развитии человеческого общества и культуры.

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1990

$\mu = \frac{1}{n} \sum_{i=1}^n x_i$

1. The first of these is the fact that the majority of the population of the United States is now living in urban areas. This is a result of the process of urbanization, which has been going on since the beginning of the 20th century. The population of the United States has increased from about 100 million in 1900 to over 200 million in 1950, and the majority of this increase has been in urban areas. This has led to a concentration of population in a few large cities, which has in turn led to a number of problems, such as overcrowding, pollution, and traffic congestion.

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 | 2042 | 2043 | 2044 | 2045 | 2046 | 2047 | 2048 | 2049 | 2050 | 2051 | 2052 | 2053 | 2054 | 2055 | 2056 | 2057 | 2058 | 2059 | 2060 | 2061 | 2062 | 2063 | 2064 | 2065 | 2066 | 2067 | 2068 | 2069 | 2070 | 2071 | 2072 | 2073 | 2074 | 2075 | 2076 | 2077 | 2078 | 2079 | 2080 | 2081 | 2082 | 2083 | 2084 | 2085 | 2086 | 2087 | 2088 | 2089 | 2090 | 2091 | 2092 | 2093 | 2094 | 2095 | 2096 | 2097 | 2098 | 2099 | 2100 | 2101 | 2102 | 2103 | 2104 | 2105 | 2106 | 2107 | 2108 | 2109 | 2110 | 2111 | 2112 | 2113 | 2114 | 2115 | 2116 | 2117 | 2118 | 2119 | 2120 | 2121 | 2122 | 2123 | 2124 | 2125 | 2126 | 2127 | 2128 | 2129 | 2130 | 2131 | 2132 | 2133 | 2134 | 2135 | 2136 | 2137 | 2138 | 2139 | 2140 | 2141 | 2142 | 2143 | 2144 | 2145 | 2146 | 2147 | 2148 | 2149 | 2150 | 2151 | 2152 | 2153 | 2154 | 2155 | 2156 | 2157 | 2158 | 2159 | 2160 | 2161 | 2162 | 2163 | 2164 | 2165 | 2166 | 2167 | 2168 | 2169 | 2170 | 2171 | 2172 | 2173 | 2174 | 2175 | 2176 | 2177 | 2178 | 2179 | 2180 | 2181 | 2182 | 2183 | 2184 | 2185 | 2186 | 2187 | 2188 | 2189 | 2190 | 2191 | 2192 | 2193 | 2194 | 2195 | 2196 | 2197 | 2198 | 2199 | 2200 | 2201 | 2202 | 2203 | 2204 | 2205 | 2206 | 2207 | 2208 | 2209 | 2210 | 2211 | 2212 | 2213 | 2214 | 2215 | 2216 | 2217 | 2218 | 2219 | 2220 | 2221 | 2222 | 2223 | 2224 | 2225 | 2226 | 2227 | 2228 | 2229 | 2230 | 2231 | 2232 | 2233 | 2234 | 2235 | 2236 | 2237 | 2238 | 2239 | 2240 | 2241 | 2242 | 2243 | 2244 | 2245 | 2246 | 2247 | 2248 | 2249 | 2250 | 2251 | 2252 | 2253 | 2254 | 2255 | 2256 | 2257 | 2258 | 2259 | 2260 | 2261 | 2262 | 2263 | 2264 | 2265 | 2266 | 2267 | 2268 | 2269 | 2270 | 2271 | 2272 | 2273 | 2274 | 2275 | 2276 | 2277 | 2278 | 2279 | 2280 | 2281 | 2282 | 2283 | 2284 | 2285 | 2286 | 2287 | 2288 | 2289 | 2290 | 2291 | 2292 | 2293 | 2294 | 2295 | 2296 | 2297 | 2298 | 2299 | 2300 | 2301 | 2302 | 2303 | 2304 | 2305 | 2306 | 2307 | 2308 | 2309 | 2310 | 2311 | 2312 | 2313 | 2314 | 2315 | 2316 | 2317 | 2318 | 2319 | 2320 | 2321 | 2322 | 2323 | 2324 | 2325 | 2326 | 2327 | 2328 | 2329 | 2330 | 2331 | 2332 | 2333 | 2334 | 2335 | 2336 | 2337 | 2338 | 2339 | 2340 | 2341 | 2342 | 2343 | 2344 | 2345 | 2346 | 2347 | 2348 | 2349 | 2350 | 2351 | 2352 | 2353 | 2354 | 2355 | 2356 | 2357 | 2358 | 2359 | 2360 | 2361 | 2362 | 2363 | 2364 | 2365 | 2366 | 2367 | 2368 | 2369 | 2370 | 2371 | 2372 | 2373 | 2374 | 2375 | 2376 | 2377 | 2378 | 2379 | 2380 | 2381 | 2382 | 2383 | 2384 | 2385 | 2386 | 2387 | 2388 | 2389 | 2390 | 2391 | 2392 | 2393 | 2394 | 2395 | 2396 | 2397 | 2398 | 2399 | 2400 | 2401 | 2402 | 2403 | 2404 | 2405 | 2406 | 2407 | 2408 | 2409 | 2410 | 2411 | 2412 | 2413 | 2414 | 2415 | 2416 | 2417 | 2418 | 2419 | 2420 | 2421 | 2422 | 2 |
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1. The first step is to identify the problem. This involves understanding the current situation and the goals that need to be achieved.

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in eliminates ice salt weight and expenses from
total of shipment of Paul Atlas.

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| Year | Age | Sex | Location | Notes |
|------|-----|--------|--------------------------|--|
| 1971 | 4 | Male | 1000 ft. above sea level | 1st record of this species in the area |
| 1972 | 4 | Female | 1000 ft. above sea level | 2nd record of this species in the area |

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TRADE-MARKS
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Charles Hoff—the One-Man Track Team

(Continued from page 25)

whether it is a very good book or a very bad one. I became interested in sculpture, and at that I worked hard too. Music? Yes, I have studied music, but in that I have not done so much. It is to journalism that I have given most of my time and effort, for that is my real profession. And always I have trained hard for athletics—every day, when other things have allowed me the time."

I asked Hoff how he had happened to become a pole vaulter, when that was the one event he had not practiced.

"In Norway," he said, "we are not rich enough to have an athletic coach in each school and club. So we have a national coach, who works at the University in Oslo, and in other places. His name is William Kreigsmann, and he is one of the greatest coaches in the world.

"ONE day, after I had been graduated from the university, Mr. Kreigsmann came to me and said: 'Charles, you are a pole vaulter.' I said that pole vaulting was one event at which I was hopeless, but he insisted that I try it. So I tried it, and he must have been right for ten months later—in September, 1922, I broke the world record by vaulting thirteen feet six inches. Mr. Kreigsmann, as I said, is a very great coach."

Hoff then told me some of his theories concerning the science of pole vaulting. His style varies somewhat from the form used by American vaulters, who start to lift their bodies by their arms almost as soon as they have planted their poles and leaped into the air.

"IT IS mostly the speed of the run that carries the pole to a vertical position and the vaulter's body into the air," he said. "Taking a cane from a corner, he demonstrated.

"It is easier," he said, indicating a point eighteen inches from the top of the stick, "to lift a weight fastened here, than it would be to lift a weight—a long-fingered hand moved almost to the top of the cane—fastened here. You see? The lower the weight, the less power is required to swing the pole into a vertical position. For that reason, after I have planted the pole and made my leap, I keep my arms almost fully extended above my head until the pole is approaching the vertical, then I lift my body by the arms and cross the bar without using the jackknife kick that most American vaulters use. My way is best for me, perhaps there is best for them."

Hoff established a new world indoor record in each of his competitive appearances last winter. His last effort resulted in a vault of 13 feet 8 inches. His present outdoor world record, made in Denmark in 1923, is 13 feet 11 inches, but last September in Albi, Finland, the home town of Paavo Nurmi, he vaulted 13 feet 11 inches, a mark which probably will be accepted as a new world record at the next meeting of the International Amateur Athletic Federation. Hoff expects to do 14 feet 2 inches in. (Continued on page 123)

Charles Hoff—the One-Man Track Team

(Continued from page 122)

the American championships in Philadelphia next July. The limit of human ability in this event? Hoff shrugs his shoulders. Perhaps it will be 14 feet 6 inches, perhaps even 15 feet. He does not think that any vaulter ever will beat 15 feet.

Hoff's marvellous skill in pole vaulting is likely to cause you to lose sight of his equally marvellous ability as an all-around track and field performer. Many good judges think that he can defeat any man in the world in an all-around test.

IN A seven-event indoor competition that was a feature of the Knights of Columbus games in New York last winter, Hoff established new indoor world records in the pole vault and the running broad jump, and won by a large margin over Emerson Norton, Georgetown University's fine all-around athlete. Harold Osborn, the American's laurel champion and holder of the world high jump record, was forced out of the competition by an injury, leaving the question of supremacy unsettled between him and Hoff. The Norwegian's performances in the seven events were as follows:

Sixty yards, 6.6 seconds; running high jump, 5 feet 9½ inches; 16-pound shot, 33 feet 1½ inches; running broad jump, 23 feet 7½ inches; 40-yard hurdles, 8.2 seconds; pole vault, 13 feet 7 inches; 440 yards, 10.8 seconds.

Hoff had the contest won before the last event was decided, and did not extend himself. If it had been necessary, he could have done the 440 yards in fifty-one seconds, even after having competed in six other events.

In spite of Hoff's easy manner and apparently effortless method of doing things that are almost impossible, his chief characteristic is a determination to make a success of anything he undertakes. To work up from a weakly boyhood to a world championship requires courage and patience. Hoff has a large stock of these valuable qualities, and he has used them in his work as well as in his sport.

IN STARTING this article, I spoke of Charles Hoff as an ambassador from the youth of Norway to the youth of America. He is more than that. He is an ambassador of success to those who seek it. He is living proof that the qualities which win success in one field of endeavor will win it in another—that if you give to your job, whatever it may be, the same painstaking effort that Hoff gave to his job of mastering the intricacies of pole-vaulting form, you will make as great a success of your job as he has of his.

In Hoff's mind, there always is a picture of a pair of vaulting standards with the bar set higher than it ever has been set before. When he achieves one record-breaking height, he shoves this mental bar up another few inches. He would not be the great champion that he is if in this mental picture the bar were set at a height easy to clear.

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His Reaper Feeds the World

(Continued from page 16)

McCormick was just that kind of man.

The arrival of eight orders for reapers from Cincinnati in a single summer convinced him that the rolling lands and level plains of the West offered the most promising field for his reaper, so with \$2000 in his belt, he set out on horseback for the grain country. For three thousand miles he traveled through Ohio, Missouri, Illinois, and Wisconsin.

This is the country for my reaper, he wrote back home. Out where the level fertile fields stretched endlessly, he knew that only machinery could prevent waste of the tremendous crops as they ripened. In Illinois, he was appalled to see farmers turn pigs and cattle loose in the wheat fields. A gigantic crop of 5,000,000 bushels of wheat had swamped the growers. Rather than let it rot, they were feeding it to the stock.

FOR the first time, McCormick saw Chicago—an ugly, straggling town of 10,000 persons, built on a mud flat, frogs croaking curfew, no railroads, no canals, seemingly a most unpromising place. Yet he could vision here a future thriving center of agriculture and industry.

In quick time he was located in Chicago, turning out his reapers. The gold rush of '49 gave him a promising start for thousands of farm hands, joining in the stampede to California, left the farmers helpless. In this emergency, McCormick supplied them with machines to take the place of human hands.

The business of reapers grew and prospered, and McCormick's fame spread not only throughout the states but also across the sea. In England, where he exhibited his machine in 1851, it was decided at first, but eventually it was hailed as a revolutionary invention.

WHEN the Civil War came, the machine proved an invaluable aid to the North. "The reaper," said Edwin M. Stanton, secretary of war, "is to the North what slavery is to the South. By taking the place of regiments of young men in the western harvest fields, it releases them to do battle for the Union at the front and at the same time keeps up the supply of bread for the nation and the nation's armies. Thus, without McCormick's invention, I fear the North could not win and the Union would be dismembered."

Europe, still reaping its grain by hand, could not understand how America, with every third man at war, and supporting two armies, nevertheless could export to other lands 200,000,000 bushels of wheat.

Seldom if ever has an inventor so thoroughly "sold" his creation to the public through his own efforts. When public interest seemed to lag, McCormick would load a reaper on a flat car, attach the car to a freight train and ride along with it. Whenever he came to a field of ripe grain, he would stop the train, unload the reaper, reap for an hour or so, and then move on for new fields to conquer.

With equal vigor he fought for what he believed to be his rights as an inventor. When a seven year extension of his pat-

ent was harked on the ground that an invention of such benefit to the public should be free for all, he carried a bitter fight to the highest court in the land and even to Congress. Only when McCormick had exhausted his last legal resource, did he finally admit defeat.

BUT if "Fighting McCormick" was jealous of his invention, he was equally quick to recognize and adopt improvements and additions. There was the instance of a bedridden cripple, Jearson Atkins, who, in whole away the time, kept a reaper outside his window and drew sketches of it. One day he showed one of these sketches to a friend.

"If they would attach two revolving arms like this," he explained, "there would be no need of a man to rake the cut grain off the platform."

That was the beginning of the Atkins' self-raker nicknamed the "iron man." McCormick saw the value of it at once, and soon "iron men" rode all of his reapers.

Again there was Charles Withington, who as a pale youth had worked in Ohio harvest fields in the summer time, binding corn. His head had whirled under the hot sun as he stooped to pick up the corn. One day, years later, Withington mounted the steps of the handsome McCormick home in Chicago and rang the doorbell timidly. He was admitted to the parlor where Cyrus, big, heavy and dominating, sat in an easy chair.

"My name is Withington," the visitor said shyly. "I live in Janesville, Wisconsin. I have here a model of a machine that will bind grain automatically." He drew from under his arm a little box.

It so happened that McCormick had worked all through the night setting a stiff business problem. The chair was soft, the stranger's voice soothing. He fell asleep. When he awoke, some time later, he found that the stranger had departed.

HAD it been a dream? The man had said "bind grain automatically." Just the thing McCormick had been seeking for years! Sharply he summoned one of his employees.

"Go to Janesville at once," he ordered. "Find a man named Withington and bring him to Chicago on the first train."

The next day saw Withington back in Chicago, this time to be greeted by a wide awake man who listened eagerly to every detail. McCormick reapers immediately became self binders.

With all his tremendous driving force, with all his mastery over people and things, Cyrus McCormick still remained human. He never lost sight of the fact that others had the right to live and prosper as well as he.

To the day of his death, he continued to labor as he had from the beginning. He lived to see half a million of his reapers harvesting the world's grain, from the steppes of Russia to Peru. He lived to make America known the world over as "the land of the reaper."



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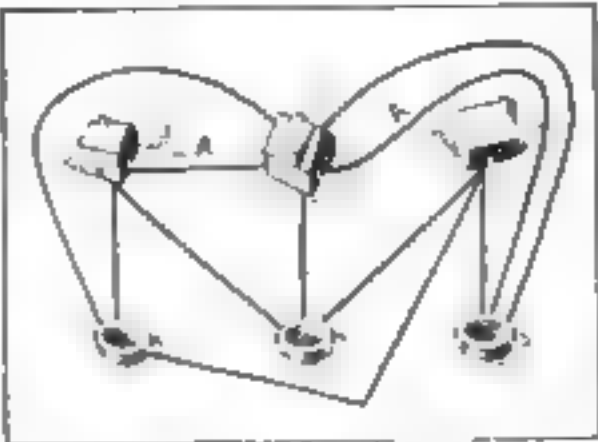
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Solutions to Last Month's Sam Loyd Puzzles

Check your answers and see
how nearly correct you were



Three Houses and Three Wells

This diagram illustrates how the three
householders laid their pipes to give each
connection with all three wells. The in-
genious fellow at the left-hand side
solved the difficulty by laying one of his
pipes under his neighbor's house. Rather
a cheeky proceeding but still warranted
by the conditions of the problem, which,
as you will recall stated merely that no
pipes should cross.

The Clock Puzzle

Here is shown how the dial may be
divided into four parts, while observing
the rule that
each of the
four parts
shall contain
numbers to
total up to a
like total in
this case 20.
Cutting it
into I and X
does the trick.



The Magic Square

| | | |
|---|---|---|
| 3 | 2 | 7 |
| 8 | 5 | 9 |
| 4 | 6 | 1 |

This is the re-
versal of the
Magic Square
principle, as
asked for in last
month's issue.
The rows, col-
umns and diag-
onals in this
square produce
eight different

totals. Did you find the right solution?

The Age of Ann

At one time Mary was three times as
old as Ann, so let us call Ann's age at that
time x and Mary's $3x$. Thus the differ-
ence in their ages must be $2x$. When Ann
will be three times as old as Mary was
at that time, then her age will be $8x$.
Then when Mary was half as old as Ann
at that time, her age would be $4\frac{1}{2}x$,
and Ann would be $2\frac{1}{2}x$. Mary is now
twice as old as Ann was at that time, or
 $5x$, and Ann must be $3x$. Their combined
ages equal 44 years, so we have the equa-
tion $8x$ equals 44, and x equals $5\frac{1}{2}$.
Therefore Mary is now $27\frac{1}{2}$ and Ann
is 16 $\frac{1}{2}$ years.

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draftsman. Without mechanical drawings
—by the thousands—every shop in the land
would be **STOPPED**.

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furnish a **guaranteed**, surplus, even to the
table, to those who start now!

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cuse that you have no ready money for this
golden opportunity. I am not so interested
in cash I want your **application**. I want at
least 200 men to start **right now**. I want
them ready to recommend by Spring. We
will get a flood of letters saying "send us
draftsmen." from every sort of industrial
and engineering concern, and we must make
good.

The **Dobe** work's pay envelope of many a
Dobe-trained draftsman has held enough to
cover the entire cost of the course! Most
students learn evenings, keeping on with
their old work until ready to step into some-
body's drafting room. The first month
equips you to take on simple drafting jobs
on the spot. It helps you learn; I gladly
permit this.

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he used to wonder where to get a job. In-
stead, he asks: "What line of work interests
me now?" And "What part of the country
suits me best?" Twenty of my graduates
went to Florida this year; three are in
Japan; last month one wrote me from
Ceylon. And I wish we had the count of
how many Dobe draftsmen have become
chiefs!

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are enrolled in a Dobe course! We receive
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just by through our course. "We'll take a
beginner," some concerns write us, "as long
as he is a Dobe-trained man and has
term right!"

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line and every curve. You couldn't make
them crooked if you tried! That's why
drafting is so easily learned; and so inter-
esting. For you do every thing by rule. So, I
guarantee to make anyone a finished drafts-
man. If you can read and write, you can
learn this line. One of my students is 51
years old; another is just seven years. But
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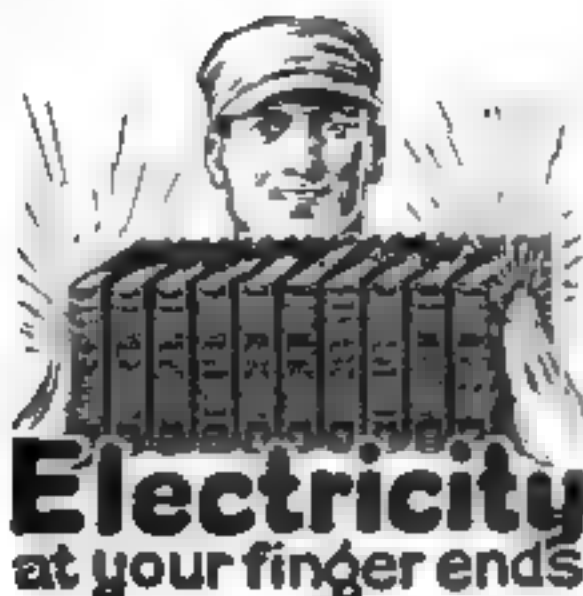
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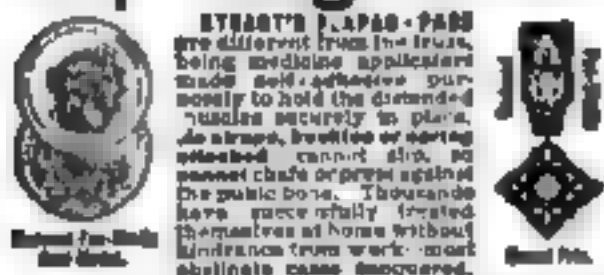
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A Foe Man Has Yet to Beat

(Continued from page 25)

diseases, gases are all still in nearly the same class with tom-cats.

It is, however, exceedingly important that the war on rats be kept up. They are a constant threat to public health. Plagues caused by rats have ravaged the world, rats are the only means of disseminating bubonic plague. The economic damage rats cause is beyond estimate. It ranges from disastrous fires to railroad wrecks and hundreds of spoiled cargoes a year.

A FEW years ago, on a certain after-noon, the signals of a railroad tower in New Jersey suddenly went mad. Green lights showed where red should have red turned up when the button for green was pressed. The danger to life and property at that critical moment may well be imagined.

An investigation hurriedly made disclosed that a dozen or more wires in a lead-sheathed cable had been short-circuited. A hole as big as a half dollar had been gnawed through the sheathing, the insulation, and actually into the wires by the teeth of a rat.

This instance recalls a queer character-istic of these rodents. They seem to enjoy nibbling at materials utterly inedible, apparently in wantonness, like walls, floors, furniture, wiring, water pipes, and even concrete.

Dr. Williams explains this fact thus: "The rat is always hungry, and he is constantly nibbling at something. He always wants to eat. And when he isn't eating he's sharpening his pronglike front teeth, which are very sharp and very wonderful. For instance, I know a case of a New Orleans rat that cut a hole four inches by three through a piece of slate flashing.

THERE'S neither taste nor nourish-ment to slate flashing. Why they attack such things we don't quite know. We're not fully satisfied with the explana-tion that it's to keep their teeth sharp-ened.

"Rats don't like coffee. And yet they do untold damage on coffee ships. I re-member a coffee ship that came here from Santos with twenty thousand bags on board, all carefully graded and sorted. When that boat arrived in this country, after only twenty-two days at sea, every bag was cut, some slashed as with a knife. We fumigated and got every rat. We got one hundred and four. See the damage done by a small colony in a com-paratively short space of time. The eco-nomic loss there was enormous.

"We had another coffee ship here on which one rat ate its way clear across the boat through forty sacks of coffee, each one of which was ruined."

It's difficult to fight rats, according to Dr. Williams, because they are much like man. They like to live together, they play and fight with each other, they turn on common enemies. Sometimes they roam. Sometimes they migrate with their chil-dren and sometimes without. A thousand were once found in one Egyptian house, 10,000 in a granary. But they don't seem

to have any definite form of government, or to bow to any recognizable form of leadership.

They're like humans, according to Dr. Williams and vindictive. He's examined 20,000,000 of them and he ought to know. Incidentally, the biggest one he ever saw was captured in New Orleans, it was eighteen inches long from the tip of its nose to the tip of its tail, and it weighed 780 grams.

There are two distinct kinds of rats: brown rats and black or roof rats. The brown rat (which came into Europe by swimming the River Volga in 1727, reaching England a year later, and Amer-ica not very long afterward) lives in the open. He is heavier and fiercer than the roof rat which he drives away. He is utterly fearless and fights ferociously when cornered. A cat will leave a full-grown Norway rat severely alone. These heavy rats have been known to attack children.

ROOF rats are smaller, less ferocious, less hardy than their brown kin. They like to live in rafters. They are ex-tremely agile, and move about like so many acrobats. They are dangerous to health for they carry infected fleas which drop off them as they scamper about.

Although the campaign of extermina-tion of the rat has not been an unqualified success, still some progress is being made. Thanks in a great measure to the work of the United States public health service, slugging is getting rid of rats. Steel structure in place of wooden is helping, as is also the fumigation required every six months by law.

Throughout the country, the Depart-ment of Agriculture is fighting rats, less as a menace to health than as an economic liability. Here again progress is being made.

The cities are much freer of rats than they used to be, partly as a result of steel and concrete construction. New York, for instance, is considered by Dr. Wil-liams not to be heavily rat-infested. The southern cities are the American danger spots, he holds, because the climate is so friendly to rats. Coastal cities are in con-stant danger.

BUT one does not wonder that the rat problem is not easy to solve when instances such as those that follow are fair examples of their brilliance, unblin-ness, wit, and ingenuity.

In Beaumont, Tex., a center of rice cul-tivation, part of the year the residents have trouble with rats in their homes, stores, and warehouses. But once the rice season starts, they find themselves free of the pests. The rats migrate to the fields. Like an army on parade, they march to the rice fields, eat themselves through a comfortable and pleasant vacation, and when the season is over go back to town.

Dr. Williams and others who have studied rats have watched this migration. They have seen rats come from town and swim moats to the rice fields. He has watched rats swim twenty feet under water in these. (Continued on page 129)

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Before You Go Auto Camping

(Continued from page 6)

that were and tape I'll nuss my guess.

I don't need to tell you to drain the crankcase and fill it up with fresh oil just before you start or to remind you to grease the car thoroughly. You know enough to do that, of course. It wouldn't do any harm to clean out the old lubricant in the transmission and rear end and put in a fresh supply.

Don't you think it would be a good idea to take the storage battery out and give it a good charge before we start? Henry asked.

"NOTHING doing!" replied Gus emphatically. "Your car is new and the battery will get a lot more charging than it needs on the trip a way—mess you run your camp light from the storage battery. That's assuming of course that you are on the road almost every day. Make sure that there is plenty of water in it before you start and it would be a good idea to take off the terminals and scrub them with a bit of sandpaper. The least bit of corrosion at that point will interfere with the operation of the self-starter."

What kind of a camp light is that you are talking about? Henry inquired.

"Nothing but a socket fastened into the hole in an ordinary green tin electric light shade and connected to a long drop-light cord and a plug so that you can put it in place of the dash light," replied Gus. "With a headlight bulb in the socket, you will have plenty of light to read by."

"By the way," Gus went on, "is there any way of getting gasoline out of your tank for the gasoline stove?"

There's a petcock on the bottom of the tank for that, Henry replied.

And if you use it you will drain your vacuum tank dry and then wonder why the engine won't start next morning. You ought to know better than that, Henry said Gus reprovingly.

You can fit a petcock in the gasoline pipe between the main tank and the vacuum tank but after all the best bet is to take along a three-foot length of rubber tubing and siphon the gasoline from the main tank. You can start the siphon by pushing the tubing all the way into the tank and then hold your finger over the end while you pull it out and stick it to the floor opening to the gasoline stove.

Have you bought your camp equipment yet? broke in Joe Clark.

Not yet, replied Henry. That score of the things I want to ask you about. What would you suggest?

"WELL, let's see," Joe paused thoughtfully. "Of course you'll need a tent, unless you want to fix the front seat of the car so that it will fold back to form a bed. You'll have to decide whether you want a tent that hitches on to the side of the auto or one that is entirely a unit by itself. And I certainly recommend a gasoline stove. Saves a lot of time rustling firewood and it's easier to cook on than a wood fire that is never the same heat twice running. A portable ice box is a big help unless you are going

to travel where you can buy food fresh every day. You can get a folding kit that includes pots and pans and dishes, or you can lay in a stock of paper plates and cups so you won't have to spend so much time washing dishes. Don't forget a staple first aid kit."

"Sounds like good dope," said Henry as he rapidly jotted Joe's suggestions in his notebook. "Grace wanted me to ask you and Uncle Gus around for Sunday dinner, and you can look over our outfit afterward, he finished."

What's this a dress rehearsal? said Gus as he and Joe stepped into the dining room the following Sunday to find both Grace and Henry in camping togs.

It certainly is Uncle Gus, laughed Grace. For the dinner is being cooked on that cute little gasoline stove."

"Well, I'd say there is certainly nothing the matter with that stove," exclaimed Joe as Grace brought in a steak that was cooked to a turn.

And the rest of the dinner added further evidence that the stove was good.

"NOW we'll show you a real test," said Henry when dinner was over. And he led the way to the car parked back of the house. "Just watch and see how quick we can get the tent up."

"Gosh," exclaimed Joe admiringly. "You two are the original lightning change campers—couldn't have taken you ten minutes."

Henry grinned at Gus, as they climbed into Gus's car after winning the young couple a load of luck on their trip. You're a big one to be giving out information on a do-camping! Why you never spent a night under canvas.

Never at home, said Joe with a broad grin. I'd spend most of my time auto camping. I wasn't tied down so tight helping out the Model Garage.

Next Houses May Be Steel

Use of steel, however, is not being confined solely to the framework of such structures. One of the most successful of the new types of steel bungalows has walls of steel sheets. Walls and partitions are made up of interlocking steel plates. The cost of the thirteen tons of steel used in the framework of one of these houses, it is said, is less than it would be for wood.

Of course, the most important advantage claimed for the new steel type of small home is its increased safety. It is said to be fireproof, lightning-proof, storm-proof, and as nearly earthquake-proof as any building that can be designed. In addition, it is easier to keep clean, and therefore is more sanitary. The smooth, tough steel surfaces defy mice and vermin.

As for appearance, those who see a great future for the steel home declare that if architects can make modern skyscrapers into monuments of lofty beauty, they can even more easily design attractive steel residences.

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W. F. Knecht, Buffalo, N.Y., writes: "I sharpened 94 lawn mowers last season, and the receipts were nearly \$2100.00 which is not bad for a side line."

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Ernest Graham, Middlebury, Conn., writes:

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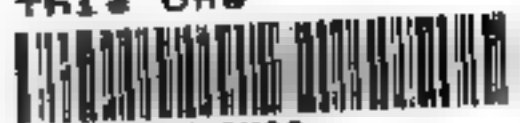
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The Home Workshop

Arthur Wakeling, Editor

You Can Make This Spanish Galleon

A Superbly Decorative Ship Model Simplified for Beginners—The Design Is Genuinely Authentic and Can Be Copied at Small Cost

By CAPTAIN E. ARMITAGE McCANN

WITH stately tread El Senor Caballero Juan Flores de Sidonia walks the high poop of his great-ship or galleon, the Nuestra Senora Afortunado, one of the finest of His Most Catholic Majesty's Armada from Spain and other Mediterranean ports.

His ship, though neither speedy nor weatherly, is heavily armed and gaily decorated as becomes so noble a vessel. She is bent upon the vengeful task of subjugating Britain's might. She did not accomplish this, being badly stung by Drake in his wasp of a ship, but, luckily for us, she escaped destruction and later carried untold treasure from the Spanish Main.

Thus, with a little skill and a lot of patience, we are able to reproduce in miniature this magnificent galleon.

The model depicted is not really intended to be any particular galleon, but it is a good sketch model of this type of ship as it actually existed. Every department store is flooded with so-called galleon models; they are not models at all, but merely decorations with a ship-model motif, and bear but little resemblance to any ship that ever floated.

HERE, however, is a model designed from contemporary plans, engravings by Vroom, with other reliable data. It is somewhat simplified and every detail is not embodied, but in general line and in such detail as appears, it is, I believe, a good replica, well proportioned and sufficiently ornate. Those who wish can simplify still further, or, on the other hand, substitute real carving pasteboard and beads.

The size over all is 30 by 30 in., the scale approximately $\frac{1}{4}$ in. to 1 ft.

The essential tools are merely the usual home workshop or carpenters' tools, with, in addition, some pin twist drills; a very small hammer; and, of course, a sharp pocket-knife. A few special tools will be needed for the rigging later, but nothing unusual or expensive.

First of all, a full-sized working drawing of every part should be made. You

(that is, three or five thin, *thin, they in, had a good*) glued together to form a 1 in. thick, solid wood, or, in some places, wherever cardboard is mentioned may be substituted. Always look over your own lumber pile and junk box first, chances are that you will be able to obtain almost everything you need to make the model, provided you use a little ingenuity in utilizing the available materials.

The center piece A (Figs. 2, 3, and 5, is cut from a piece of three-ply (or wood 8 by 25 in. the full-size view the bottom of print No. 46 as a plot, or transfer line to the bottom first drawing squares to set guide lines. The of this piece to the outside the hull, as in 5, except along top, where the 1 been made has enable you to the shape mor



Fig. 1. Captain McCann, one of the world's leading authorities on ship models, at work on the POPULAR SCIENCE MONTHLY galleon. If you asked him what he was doing, he would tell you in three words, in the language of a navigator — "frapping the gunwoning"

can save most of the work of making your own drawings by sending 50 cents to the Blueprint Service Department of POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York, for Blueprints Nos. 46 and 47. Use the coupon on page 89.

Where any particular material is mentioned, that is the kind the writer has found the best adapted to the purpose. *primary consideration is given to working. Other materials may be used; for example, where plywood*

pine is best. It can be thick (planed). Glue together four pieces $3\frac{1}{4}$ in. wide and Mark the construction lines a, each piece (Figs. 2 and 5). On (upper side) mark the deck or part A and cut away to this the profiles at the bow and a.

Make cardboard templates to correspond to the six section lines 2, or trace them directly from No. 46. Cut (Cg

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You Can Be Your Own Decorator

How to Apply the Popular Mottled or "Tiffany" Finish on Painted Walls—The Secret of Blending the Colors

By BERTON ELLIOT, *Painting and Decorating Expert*

"IT LOOKS like tapestry,"—
"Wonderful!"—"I never had
any idea painted walls could
look like that."

These were some of the remarks
made by our neighbors when we re-
decorated our downstairs rooms, a few
years ago, in the now very popular
"Tiffany" finish—a paint stippling
treatment.

Friends and neighbors had watched
this little decorative operation with
much interest, mingled with wonder-
ment, knowing that I was a "paint
man" and decorative counsellor. I
had promised to show them something
fine in painted wall decoration, but
they did not visualize what it would be
as paint stippled walls were not
usual.

My first account of just how
work was done—it was
the handiwork of Friend Wife
and myself—will be helpful to
others who wish to try this
simple yet exceptionally effec-
tive method of decoration.
The rooms, a large living
room and an average sized
dining room, had previously been
papered. Wife and I
spent a couple of evenings
removing the old paper. At
last, with a raincoat and work-
ed of me around the
rooms, we saturated the paper
in water, applied
a whitewash brush,
along behind with a
putty knife, ploughing
the paper off in
with a quick-starting, upward
stroke. The secret of removing wallpaper,
y, is to have it well saturated.
When thoroughly soaked, may
be peeled off the wall.
If the plaster,
is damaged in the process,
with patching plaster.



Hit-and-Miss Painting

The glaring colors are applied
in irregular spots of varying
sizes and later stippled with a
cloth. At the left, Mr. Elliot
is seen mixing the colors.



The paper off,
we were ready to
apply the decora-
tion. We had de-
cided on a "Tif-
fany" effect for
both rooms.

We had no precedents to guide us in
selecting colors, but now paint manufac-
turers furnish sheets prepared from the
actual materials to show various "Tif-
fany" effects, with specifications for pro-
ducing them.

This type of decoration is produced by
applying a foundation of flat wall paint,
over which is stippled or mottled a coat
of "glaze colors." These are transparent
oil colors of great clearness and brilliance,
which permit the underbody color of the
flat foundation coats to show through to a
considerable extent, producing a rich,
luminous depth of color. The stippling
is usually done with a cloth or crumpled
newspaper.

The effects we decided on were:

For the living room: Foundation coat,
Caen stone (flat wall paint). Mottling
(glaze) colors, ivory drop black and burnt
umber.

For the dining room: Foundation coat,
Caen stone (flat wall paint). Mottling
(glaze) colors, cobalt blue and Japanese
brown.

These two effects would insure similar
unity in tone to provide the desirable col-

tie-up between two adjoining rooms,
yet each room would have distinct
individuality of its own.

The ceilings in both rooms were Caen
stone wall paint in plain color—this
delightful pinkish shade toning in with
the side walls.

In doing the foundation coating, two
coats of Caen stone were applied with
a 4-in. wall brush, the first coat being
mixed with an equal part of varnish
size (mixing size) to seal the porous
plaster, which otherwise would absorb
the paint like a blotter and make a sat-
isfactory finish impossible, no matter
how many coats were applied.

Two coats are sufficient for a "Tif-
fany" foundation coating, although in
applying wall paint in plain colors,
especially delicate shades as for the
ceiling, three coats ordinarily are re-
quired for a first-class job.

IN APPLYING wall paint it is better
to use criss-cross or zigzag strokes,
which tend to keep the brush marks
from showing. The paint should al-
ways be stirred thoroughly before
using, and if it should spread a little
hard and drag under the brush, a small
amount of turpentine will make it
work easily.

Twenty-four hours should be allowed
for drying between coats. If there are
any broken places or cracks in the
plaster, they should be filled with patch-
ing plaster (see page 98) before the paint-
ing is started.

As soon as the foundation coating was
thoroughly dry, we were ready for the
stipple coat.

A little ivory drop black was squeezed
from a small tube of "glaze color" into
a receptacle of "glazing liquid," a prepa-
ration sold for the purpose by nearly all
first-class paint stores. Proportions were
experimented with until the desired shade
was obtained. (Continued on page 97)



Fig shown half size—raw umber
on a straw-colored foundation



Mr. Elliot shows how the glazing colors
stippled or mottled with a clean, crumpled



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never separate
from Tuxedo**

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